

# Northern Arizona University Multimodal Assessment

RECOMMENDATIONS MEMORANDUM



MARCH 2018 | FINAL 3/12/2018

Prepared By:

**Kimley»Horn**

*333 E. Wetmore Road  
Suite 280  
Tucson, Arizona 85705*

## Contents

1.	Introduction.....	5
1.2	Study Area.....	6
2.	Multi-Modal Network and Existing Conditions.....	7
2.1	2013 NAU Campus Traffic Circulation study.....	7
2.2	2015 landscape master plan.....	7
2.3	Campus Network.....	7
2.4	Crash Analysis .....	9
3.	Campus Community Outreach.....	11
4.	Stakeholder Interviews.....	15
5.	Needs Analysis .....	16
6.	Recommendations .....	21
6.1	On-Campus Project Recommendations .....	21
6.2	Off-Campus Recommendations.....	47
7.	Other Recommendations .....	49
8.	Facility Design Guidelines.....	52
	Appendix .....	53

## Figures

Figure 1. Campus Crash Locations .....	10
Figure 2. Preliminary Issue Area Location.....	17
Figure 3. Shared Lane Markings Source: NACTO .....	23
Figure 4. Bicycle Lanes and Shared Lane Markings: San Francisco St., Pine Knoll Dr., Knoles Dr. ....	24
Figure 5. Examples of uphill Bike Lanes and Shared Lane Markings .....	25
Figure 6. Long-Term / Ultimate Cross-Section Bicycle Lanes. ....	26
Figure 7. Proposed Cross-Sections: San Francisco Street: Mountain View to Hilltop Homes.....	27
Figure 8. Proposed Cross-Sections: San Francisco Street: Hilltop Homes to McConnell Dr. ....	28
Figure 9. Proposed Cross-Sections: San Francisco Street: McConnell Dr. to Pine Knoll Dr.....	29
Figure 10. Proposed Cross-Sections: Pine Knoll Dr.: South of McConnell Dr. Intersection.....	30
Figure 11. Proposed Cross-Sections: Pine Knoll Dr.: 25' Cross-Section .....	31
Figure 12. Proposed Cross-Sections: Pine Knoll Dr.: 31' Cross-Section .....	32
Figure 13. Proposed Cross-Section: Knoles Drive, McConnell Drive to University Drive .....	33
Figure 14. Project #2, #3, and #5 - McConnell Road / Pine Knoll Drive Improvements, Roundabout Option.....	35
Figure 15. Project #2, #3, and #5 - McConnell Road / Pine Knoll Drive Improvements, Signalized Intersection Option .....	36
Figure 16. Project #5- LSMP Project S.13, McConnell Entry Parking Lot .....	37
Figure 17. Project #9- McConnell Dr. and San Francisco St. Intersection and Connectivity Improvements..	40
Figure 18. Project #11- South Campus Pedway, P62/Pine Knoll to Walkup Skydome .....	42
Figure 19. Project #14- Runke Drive to San Francisco Street Pedway .....	44
Figure 20. Project #15- Knoles Drive and Knoles to McCreary Pedway .....	46
Figure 21. Milton Road BikePedWay Segments .....	48

## Tables

Table 1. Crash Type Summary.....	9
Table 2. Summary of Issue Areas.....	18
Table 3. Focus Area 1, Campus Streets Bicycle Lanes.....	23
Table 4. Focus Area 2, McConnell Dr.: I-17 to Knoles Dr.; Pine Knoll Dr. – McConnell Dr. to Huffer Lane .....	34
Table 5. Focus Area 3 – Pine Knoll and San Francisco Street Improvements.....	38
Table 6. Focus Area 4 – South Campus “Pedway”, P62 Parking Lot to Walkup Sky Dome .....	41
Table 7. Focus Area 5 – Knoles Drive, University Drive to McConnell Drive .....	43
Table 8. Focus Area 6 – Central Campus; Blome Dr. (near Raymond Hall), from Knoles Dr. to NAU Trail/Pedway .....	45
Table 9. Travel Demand Management Strategies .....	49

## 1. Introduction

This document presents recommendations to improve multimodal mobility and safety on the campus of Northern Arizona University, in Flagstaff, Arizona. The document also summarizes existing conditions, and the analysis completed to assess multimodal deficiencies, needs, and opportunities on campus.

The *NAU Multimodal Assessment* evaluates the existing non-motorized network (walkways, pathways, bike lanes) on the Northern Arizona University campus to identify network and connectivity gaps, safety concerns, and other locations needing improvements to serve the multimodal mobility needs of the NAU student-body, staff, faculty, and visitors. Recommended projects include new sidewalk, pathway, and bikeway connections, on-street and separated bicycle lanes, and improved street crossings.

In addition to infrastructure-focused improvements, non-infrastructure focused investments can help to reduce the number of individuals driving to campus in single vehicles.

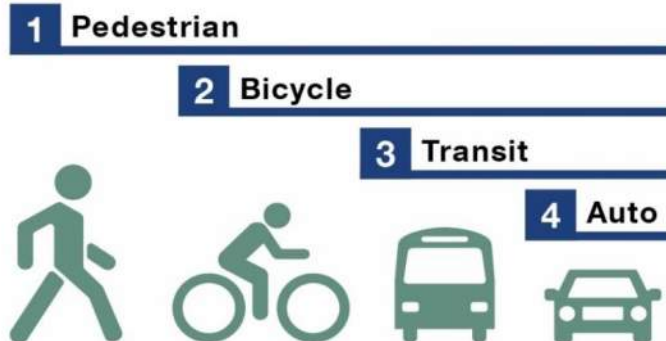
Transportation or Travel Demand Management (TDM) refers to actions and strategies that manage the demand for travel by private vehicle, rather than focusing on accommodating the demand. Travel demand recommendations are provided in Section 7.

The *NAU Multimodal Assessment* identifies improvements, that upon implementation will make walking, bicycling, and transit more comfortable and convenient. These improvements will increase the number of individuals who choose to travel around campus by bicycle, walking, and transit. This will lead to improved safety and reduced congestion for all users.

## Modal Priorities

It is recommended that Northern Arizona University adopt policies and practices to ensure that campus streets improvement projects are designed for all users – pedestrians, bicyclists, transit, and vehicles. Balancing the needs of bicyclists, pedestrians, and transit users will require a modal hierarchy that favors pedestrians first, then bicyclists, transit riders, and automobiles. Doing so will:

1. Improve safety of all users
2. Make bicycling and walking more comfortable and convenient
3. Reduce traffic congestion by reducing the number of staff, students, and visitors who drive a vehicle to and around campus
4. Reduce the demand for expensive parking and street-capacity projects



Previous studies have addressed vehicle traffic circulation on the NAU campus, including the NAU Campus Traffic and Circulation Study (2013), and the Traffic Analysis of San Francisco Street, Franklin Avenue to Blome Drive (2014). As such, the focus of the *NAU Multimodal Assessment* is to identify projects that specifically improve safety and convenience for those walking, skateboarding, bicycling, and accessing transit.

NAU recognizes that for many people, driving is the only alternative, particularly for those who live more than 5-miles from campus. However, for those who live less than 5-miles from campus, walking or riding a bicycle represents a very viable mode of transportation. As such, *NAU Multimodal Assessment* recommendations are focused on those who live less than 5-miles from campus.

To meaningfully increase the number of those who commute to and around campus by walking, bicycling, or riding a bus, NAU must prioritize these modes above driving. While driving will remain an important and viable commuting alternative, as staff, students, and visitors experience that walking and bicycling are more convenient than driving, they will be more likely to make it their preferred transportation mode. This will result in fewer vehicles on NAU campus and make it safer and more comfortable for bicyclists and pedestrians.

## **1.2 STUDY AREA**

NAU is in Flagstaff, Coconino County, Arizona. Coconino County has a population of 140,908. Flagstaff, the largest municipality in the County, has a population of 71,459 (U.S. Census, 2016) and covers approximately 65 square miles. At an elevation of 6,950 feet, Flagstaff is surrounded by the largest contiguous ponderosa pine forest on the North American continent and enjoys a four-season climate.

Enrollment at NAU exceeds 30,000, including on-line, and other statewide campus locations. Enrollment at the Flagstaff campus is 22,124 (Fall 2016) and total faculty and staff are 4,677. The Flagstaff campus is situated on approximately 708 acres (approximately 1.1 square miles).



## 2. Multi-Modal Network and Existing Conditions

This section summarizes previous NAU studies, existing bicycle and pedestrian facilities, and crash data.

### 2.1 2013 NAU CAMPUS TRAFFIC CIRCULATION STUDY

The NAU Campus Traffic and Circulation Study (2013) evaluated existing traffic conditions on campus, projected the impact of campus growth and enrollment increases on campus streets, and identified transportation improvements that are needed to accommodate the continued growth.

The 2013 Study recommended right turn lane improvements at San Francisco Street/Franklin Avenue, intersection control reconfiguration at San Francisco Street/Mountain View, left and right turn lanes at San Francisco Street/University Drive, a southbound left turn lane at San Francisco Street/Pine Knoll, and a roundabout at Pine Knoll/McConnell Drive.

The NAU Campus Traffic Circulation Study complements recommendations made in this *NAU Multimodal Assessment*.

### 2.2 2015 LANDSCAPE MASTER PLAN

The 2015 Landscape Master Plan (LSMP) noted the following as it relates to multimodal conditions on NAU campus:

- Campus entrances lacking adequate pedestrian connections
- High speed bike and skateboard traffic mixing with foot traffic throughout campus
- Difficulty recognizing where a change of direction occurs or a road is encountered
- Inconsistencies in material types and absence of signage
- Lack of east-west connectivity for core and south campus
- Lacking or narrow sidewalks

The LSMP identified several locations for improvements. These are incorporated into issue area identification in later sections of this memorandum.

### 2.3 CAMPUS NETWORK

The NAU campus currently has a variety of bicycle and pedestrian facilities. Maps of these facilities are provided in the **Appendix**.

#### Pedestrian and Bicycle Infrastructure

##### *Shared Use Paths*

Shared use paths are paved facilities intended for use by both bicyclists and pedestrians, skateboards, and other non-motorized modes. They provide an alternative for bicyclists that do not feel comfortable riding with automobile traffic. They are generally slower moving because they are shared among a variety of users (e.g., faster moving cyclists and slower moving pedestrians).



*Shared Use Path*

Shared use paths are constructed in roadway right-of-way or can have exclusive right-of-way off-street. Shared use paths on NAU campus are located along key roadways including San Francisco Street (Mountain View to Pine Knoll) and Knoles Drive (University to McConnell Drive).



### *NAU Pedway*

The NAU Pedway is a shared use path that runs north-south and connects the north campus to the south campus. The Pedway begins at DuPont Avenue, and extends south to McConnell Drive. Recent extensions of the Pedway have introduced a new design elements to better manage bicycle and pedestrian traffic. The new design, picture at right, features a dark gray bicycle lane running between two lighter gray pedestrian pathways. Two tactile strips that will alert pedestrians that they are encroaching into the bicycle space.



*NAU Pedway*

### *Sidewalks*

Sidewalks are typically constructed of concrete, are narrower than shared use paths, and run adjacent to the roadway. Sidewalks are designed for the use of pedestrians and slower-moving modes. On NAU campus, they are frequently used by skateboards as well.



*Sidewalks*

### *Bike Routes and Bicycle Boulevards*

Bike routes are streets that are designated to share the right-of-way between vehicles and bicyclists with signage or pavement markings. These facilities are typically recommended for streets with relatively low traffic speeds (25 mph or less) and lower volumes. Bicycle Boulevards are local streets with signs and pavement markings to indicate that a roadway is intended as a shared, slow street. Improvements such as traffic calming and traffic diverters prioritize bicycle travel along the route.



*Bicycle Lane*

### *Bicycle Lane*

Bicycle lanes are marked lanes on the street, and adjacent to the vehicle travel lane. Bicycle lanes are for the exclusive use of bicycles. Parking is prohibited in a bike lane.

## **Bus Transit Services**

NAIPTA's Mountain Line Route 10 runs through the NAU Campus connecting downtown Flagstaff to Woodlands Village. An ecoPASS is a Mountain Line city bus pass provided at no charge to all Northern Arizona University employees, available through NAU Parking and Shuttle Services.

In addition, NAU operates two shuttle routes.

The Louie Line operates around campus in a counter-clockwise pattern. The route begins at the Rolle/McConnell bus stop. The bus stops at P65, Bookstore/Union, North Aquatics and Tennis Center, Printing Services, Geology, ARD, Campus Heights/Gabaldon, SBS, lot P62, Forestry/South Village and back to the Rolle/McConnell stop. During peak hours, 7:00 a.m. to 4:00 p.m., the buses leave Rolle/McConnell



every four minutes. During off-peak hours, 4:00 pm to 10:00 pm., buses leave every 15 minutes. After 10 pm, buses leave every 30 minutes.

The Jacks Line operates around campus in a clockwise pattern. The bus starts at the Pine Ridge bus stop and travels to Forestry/South Village, lot P62, SBS, Campus Heights/Gabalton, Tinsley, University Union, Old Main, Parking Services, BioSciences, University Union, the corner of San Francisco Street and Pine Knoll Drive and then back to the Pine Ridge stop.

The Jacks Line operates Monday through Thursday 7:00 a.m. to 10:00 pm and Friday 7:00 am. to 5:00 pm. During peak hours, 7am to 4pm, the buses leave Pine Ridge every four minutes. During off-peak hours, 4 to 9 pm, buses leave every 15 minutes. After 9 pm, buses leave every 30 minutes.

During spring, summer and winter breaks, the Louie Line is the only route and operates 7:00 a.m. to 5:00 p.m. Buses leave Rolle/McConnell on the hour and half hour.

## 2.4 CRASH ANALYSIS

Campus crash data was provided by the NAU Office of Emergency Management. The data covers the years from 2012 to 2017. The data shows 691 crashes reported within the NAU campus during the 5-year period, 131 of which (19 percent) involved pedestrians, bicycles and skateboards.

A summary of pedestrian, bicycle, and skateboard related crashes is provided in **Table 1. Figure 1** illustrates areas where higher crash rates are potentially occurring. The heat map identifies 3 areas with high concentrations of bicycle/pedestrian/motor vehicle crashes:

1. Intersection of San Francisco Street / McConnell Drive
2. Central campus around Knoles Drive and University Drive
3. North campus along McCreary Drive

*Table 1. Crash Type Summary*

Crash Type	Frequency	Percentage
Vehicle/Pedestrian	27	21%
Vehicle/Bicycle	24	18%
Skateboard/Other	21	16%
Bicycle/Object	20	15%
Bicycle/Other	17	13%
Bicycle/Pedestrian	9	7%
Bicycle/Bicycle	6	5%
Bicycle/Skateboard	4	3%
Skateboard/Object	2	2%
Skateboard/Pedestrian	1	1%



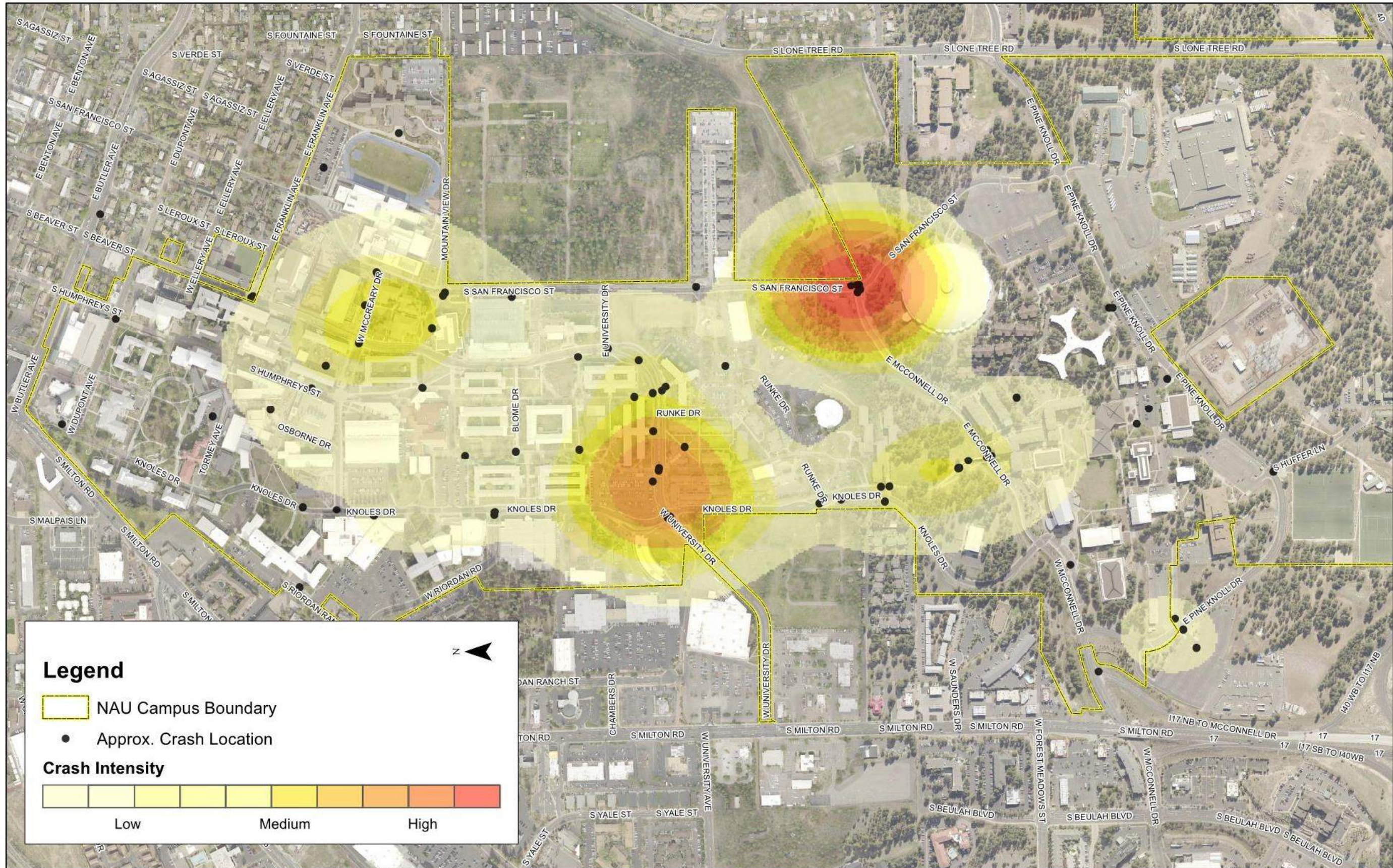


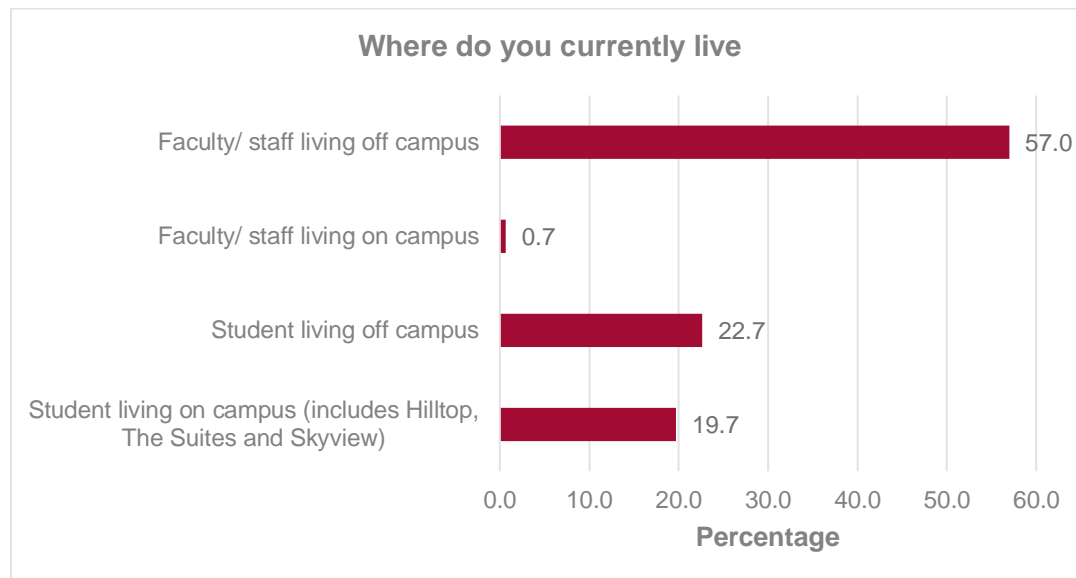
Figure 1. Campus Crash Locations



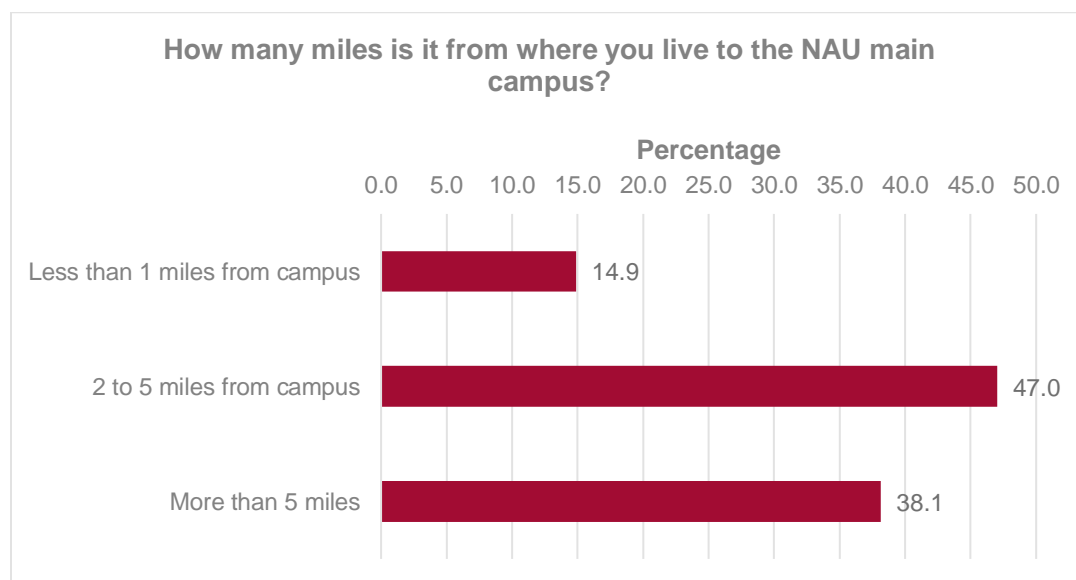
### 3. Campus Community Outreach

An email survey was distributed to NAU faculty, staff and students in November 2017 to request input on multimodal transportation conditions and preferences. A total of 12,287 emails were successfully sent. The emails resulted in a total of 1,766 responses. A summary of the overall survey results is provided below for the survey results:

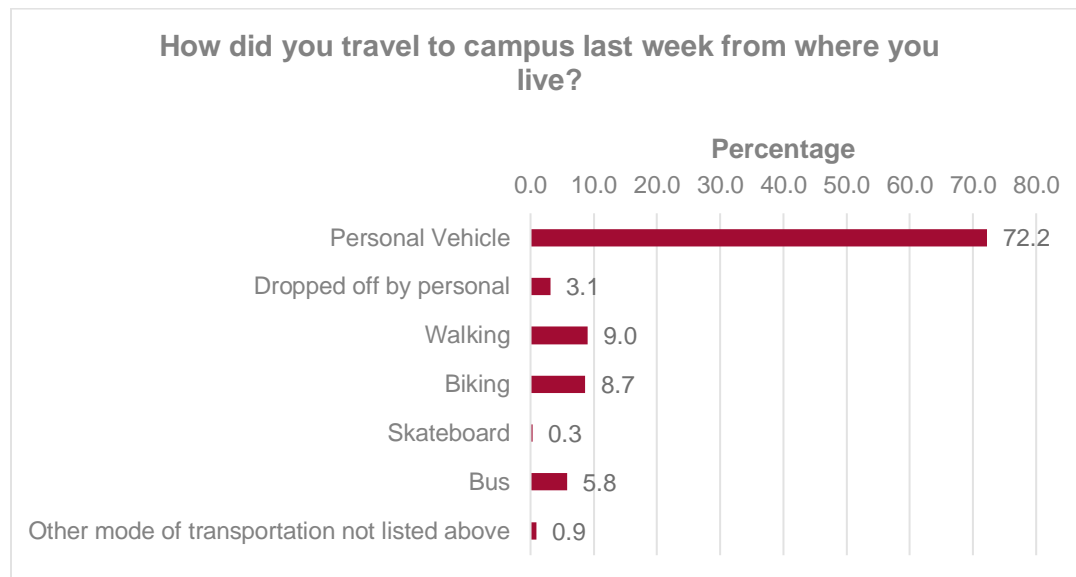
*Question 1: Where do you currently live?* – A majority of survey respondents (combined 79.7%) live off-campus.



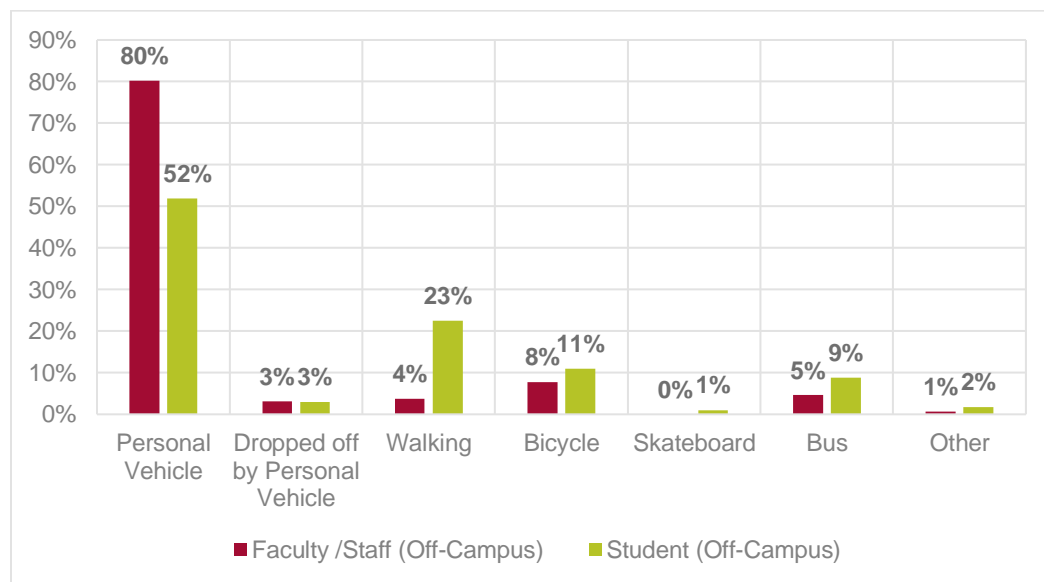
*Question 2: How many miles is it from where you live to the NAU main campus?* – 62% of respondents live less than 5 miles or less from campus, a distance that is easily covered by bicycling.



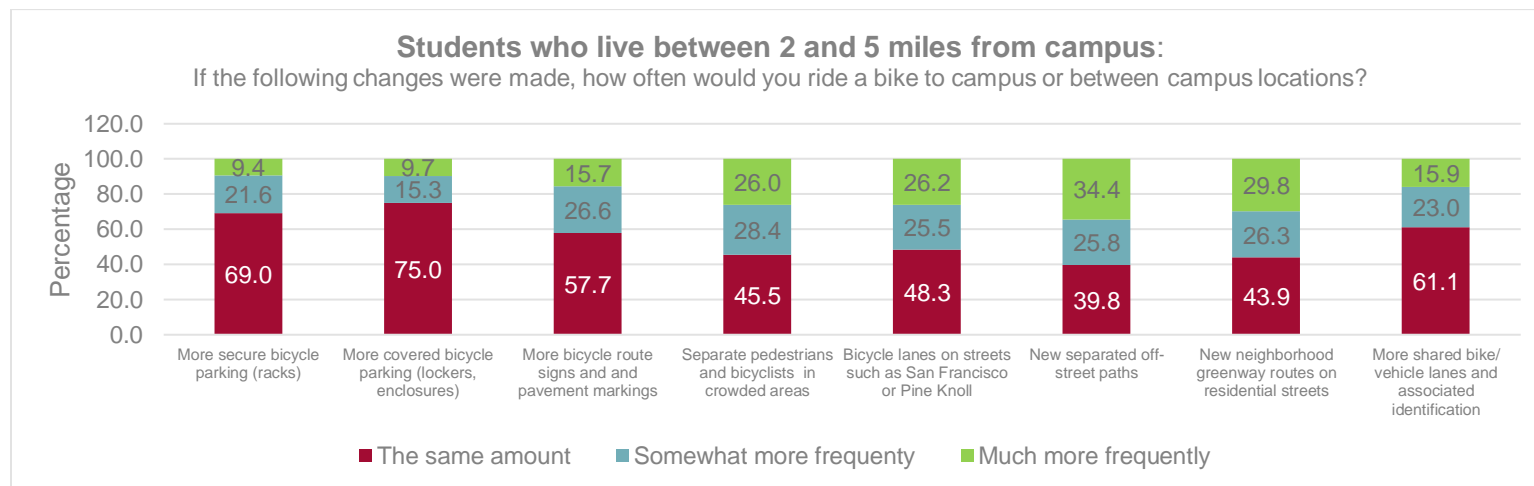
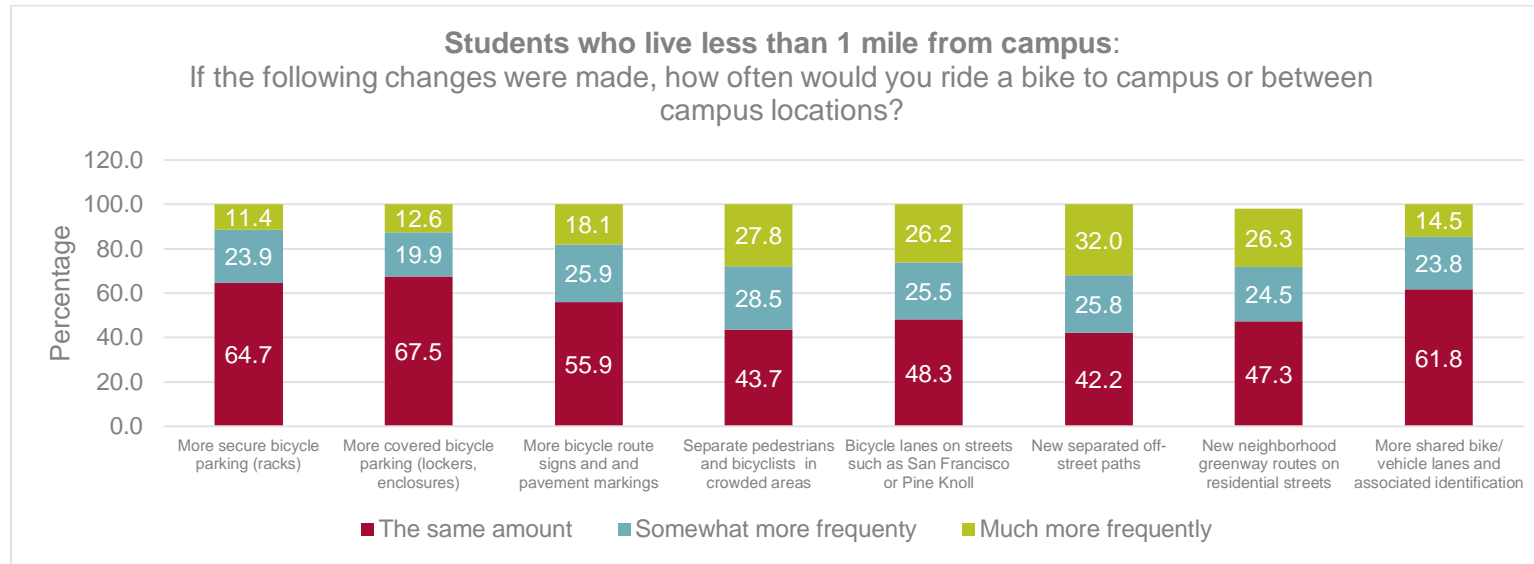
*Question 3: How did you travel to campus last week from where you live?* –Results show that over 75% of respondents used a personal vehicle to travel to NAU. Approximately 18% arrived by walking for bicycling.



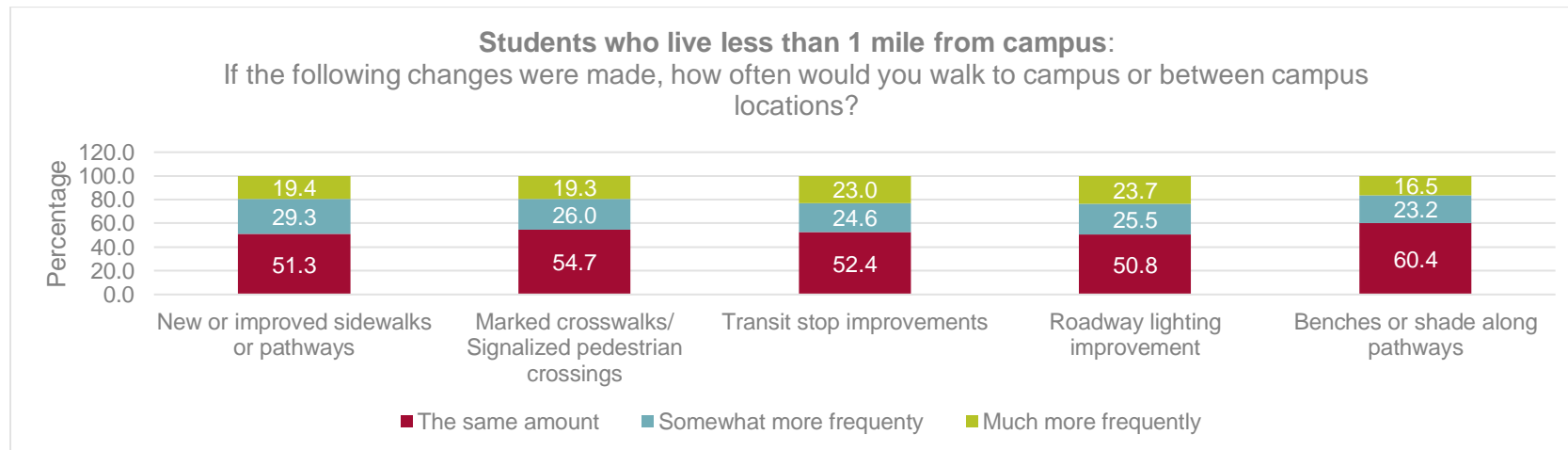
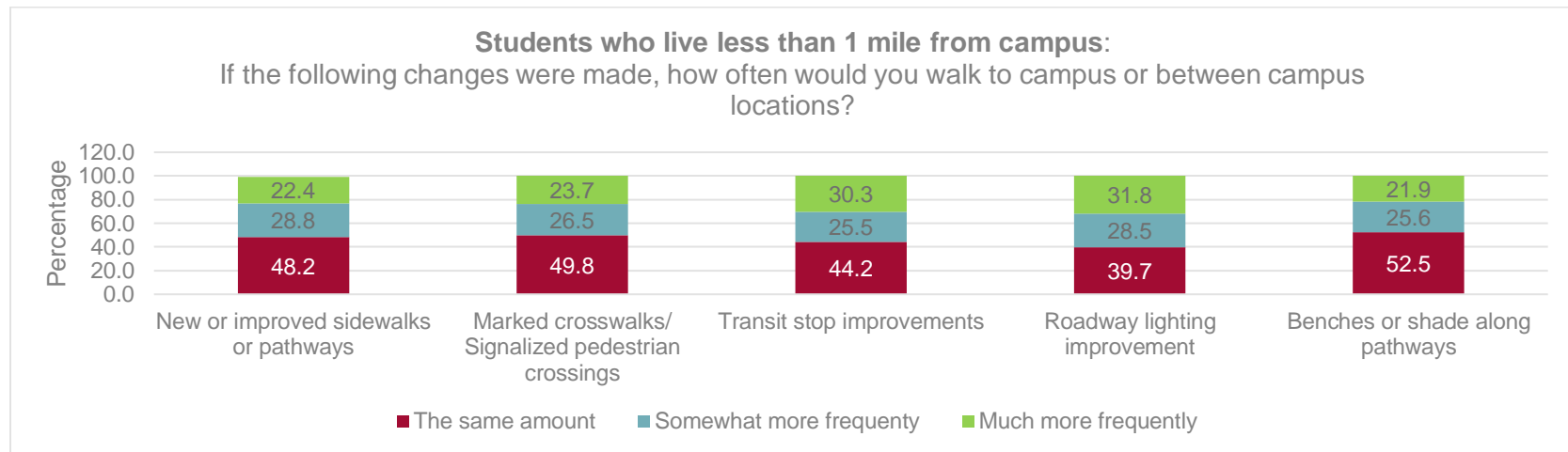
*Question 3: How did you travel to campus last week from where you live? - Off-Campus Faculty / Staff vs. Off-Campus Students.* Breaking the results into students and staff, half of students arrived by personal vehicle, and 80% of staff arrived by personal vehicle.



*Question 4: If the following changes were made, how often would you ride a bike to campus or between campus locations?* Respondents show that they would be most responsive to new separated shared use paths and greenway routes. They also indicated strong interest in separating bicyclists from pedestrians. The responses are separated for students who live less than 1 miles from campus, and those who live 2 to 5 miles from campus.



*Question 5: If the following changes were made, how often would you walk to campus or between campus locations?* Responses to this question were relatively consistent for all improvements types that were suggested. The responses are separated for students who live less than 1 miles from campus, and those who live 2 to 5 miles from campus.



## 4. Stakeholder Interviews

Stakeholder interviews were conducted October 9-10, 2017. Interviews were conducted with representatives from:

- Arizona Department of Transportation
- Flagstaff Metropolitan Planning Organization
- NAU Office of Sustainability
- NAU Police Department
- NAU College of Engineering
- Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA)

Key findings and themes are summarized below. Stakeholder meeting notes are provided in the **Appendix**.

### *Connections*

- Additional east/west connections are needed for bicycles and pedestrians. Currently, east/west travel is dependent upon Pine Knoll Drive in the south and Butler Avenue in the north.
- East-west access needs to be strengthened. The City has considered a project on Lone Tree to complete a connection to Mountain View Ave.

### *Separate bicyclists from pedestrians*

- Separation of cyclists/skateboarders is critical as mixed speeds cause issues.
- Segments with steep grades are problematic and traffic calming should be considered at these locations.
- Need separation of bike path where it merges with sidewalks.
- Very few bicycles use the transit spine route. Most desirable destinations are off pedway so bikes usually take that instead.
- Keep the Pedway configuration consistent.

### *Barriers*

- There is a need for grade-separated or protected crossings of major streets such as Milton Road.
- McConnell interchange is challenging for pedestrians.
- Franklin can also be inaccessible, especially in winter. Sidewalks are narrow.
- Milton and Butler create campus barriers. Connections are needed across Milton.



## 5. Needs Analysis

The outcome of the stakeholder interviews supplemented the identification of twenty areas that were advanced forward as preliminary “Issue Areas” as summarized in **Table 2**. The locations within the NAU campus are shown in **Figure 2**.

Issue area needs multimodal needs can range from short “missing links” on a specific street or pathway, to larger geographic areas with few or no bicycle facilities. Multimodal needs on the NAU campus include “spot needs” or “connection needs”.

### Spot Need

Spot needs are point-specific locations lacking dedicated bicycle facilities or other treatments to accommodate safer and comfortable bicycle travel. Examples of spot needs are intersections and other vehicle/bicycle conflict areas posing challenges for riders such as a bicycle lane on a major street “dropping” to make way for a right turn lanes at an intersection, or a lack of a safe and comfortable crossing treatment for pedestrians crossing a major street.

### Connection Need

Connection needs are missing segments (less than 1-mile) of sidewalk, shared use path, or bicycle lanes on a clearly defined and otherwise well-connected corridor. An example is a discontinuous shared use path, bicycle lane, or sidewalk.

### Needs Prioritization

Recognizing limited resources to implement improvements, TAC members were asked to identify the most critical multimodal needs from those listed in **Table 2**. Specifically, TAC members were asked to identify their top five issue areas. **Table 2** identifies the collective prioritization based on TAC feedback.

The highest-priority issues issue areas are:

1. Location # 1: South Campus; Pine Knoll Drive and McConnell Drive Intersection
2. Location # 3: South Campus; Access to Facility Services at San Francisco Street and Pine Knoll Drive
3. Location # 6: South Campus; McConnell Drive and San Francisco Street
4. Location #8: Central Campus; Knoles Drive and Runke Drive
5. Location #11: Central Campus; NAU Trail from Ramond Hall to Beaver Street

*Location #1: Pine Knoll at McConnell Drive*



*Location #6: McConnell Dr. at San Francisco St.*

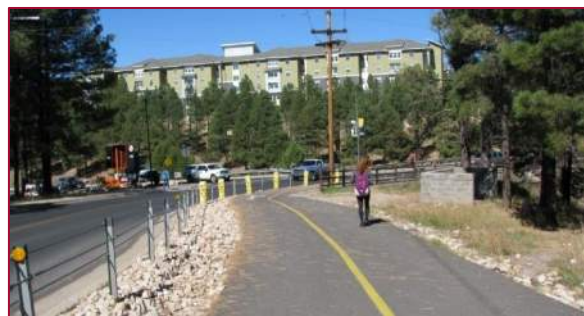






Figure 2. Preliminary Issue Area Location



Table 2. Summary of Issue Areas

Location ID	Location Description	Need Type	Needs Description	Prioritization Rating
1	South Campus; Pine Knoll Drive and McConnell Drive Intersection	Connection Need	<ul style="list-style-type: none"> <li>Safety and congestion issues; staffed by student traffic controllers during peak periods.</li> <li>Sidewalk gaps with no crosswalks.</li> <li>Bicycle facilities along McConnell Drive and Pine Knoll Drive.</li> <li>McConnell Drive runs parallel with the Sinclair Wash Trail. However, not ideal for use during or after inclement weather events.</li> </ul>	1
2	South Campus; Pine Knoll Drive	Connection Need	<ul style="list-style-type: none"> <li>Sidewalk gaps on Pine Knoll Drive.</li> <li>No bicycle accommodation on Pine Knoll Drive.</li> <li>Heavy east/west vehicle traffic, high percentage of heavy vehicle traffic.</li> </ul>	6
3	South Campus; Access to Facility Services at San Francisco Street and Pine Knoll Drive	Spot Need	<ul style="list-style-type: none"> <li>No sidewalks from Pine Knoll Drive to Facility Services building</li> <li>High percentage of heavy vehicle traffic</li> </ul>	3
4	South Campus; McConnell Drive Pedway Overpass	Spot Need	<ul style="list-style-type: none"> <li>High crashes (9 reported in the approximate area) that involved pedestrians, skateboarders (55%) and bicycles.</li> <li>Combination of travel modes (bicycles, pedestrians, skateboards) on pedway.</li> </ul>	8
5	South Campus; Walkup Skydome, eastern parking (P66) entrance	Spot Need	<ul style="list-style-type: none"> <li>Southbound lane of bicycle path abruptly ends due to utility pole.</li> <li>North and south crosswalk ends at curb on east side of San Francisco Street (not at ADA ramps)</li> </ul>	-
6	South Campus; McConnell Drive and San Francisco Street	Spot Need	<ul style="list-style-type: none"> <li>Twenty-four (24) crashes reported within vicinity of the intersection; over 50% of crashes involved bicyclist and skateboarders colliding with objects along the multi-use path; stakeholders stated that this is frequent location for medical assistance due to collisions with cable barrier.</li> <li>Sharp curve towards intersection with potential obstructions along the sides of the road and multi-use path (utility pole).</li> <li>Stakeholders identified this intersection as problematic as it is easy to speed due to steep downgrades towards the intersection.</li> </ul>	2

Location ID	Location Description	Need Type	Needs Description	Prioritization Rating
7	South Campus; Pedway on east side of Knoles Drive	Spot Need	<ul style="list-style-type: none"> <li>Four crashes near Gabaldon Hall on shared-use path; two crashes involved bicycle-pedestrian.</li> <li>Mix of both bicycles and pedestrians on the shared use path on west side of Knoles Drive; conflicts between bicyclists and pedestrians.</li> </ul>	10
8	Central Campus; Knoles Drive and Runke Drive	Spot Need	<ul style="list-style-type: none"> <li>No sidewalk along Runke Drive.</li> <li>Two reported crashes were reported within the area that involved vehicle-pedestrian.</li> <li>Crosswalk striping not maintained.</li> </ul>	4
9	Central Campus; San Francisco Street along the Hilltop Townhomes access	Spot Need	<ul style="list-style-type: none"> <li>Low crosswalk visibility at the entrance of the Hilltop Townhomes; vertical crest on San Francisco Street.</li> <li>No designated pedestrian crossing on San Francisco Street.</li> <li>Limited pedestrian/bicycle connectivity to campus west of San Francisco Street.</li> </ul>	9
10	Central Campus; University at Reilly Hall	Spot Need	<ul style="list-style-type: none"> <li>4 crashes reported (motor vehicle), 2 involved bicycles and 2 involved pedestrians.</li> <li>Sight-visibility concerns at the crosswalk for westbound traffic.</li> <li>2015 LSMP recommends median planting on University Drive with safe pedestrian crossing.</li> </ul>	-
11	Central Campus; NAU Trail from Ramond Hall to Beaver Street	Connection Need	<ul style="list-style-type: none"> <li>Way finding needed for NAU Pedway, which jogs to the west in front of Ramond Hall.</li> <li>Loading docks, south of the University Union Food Services, and service vehicles conflict with bicycle/pedestrian traffic, high skateboard activity.</li> <li>2015 LSMP suggests transforming the existing service street into a pedestrian mall (C10).</li> </ul>	5
12	Central Campus; Knoles Drive, University Union / McCreary Drive / Cline Library	Connection Need	<ul style="list-style-type: none"> <li>High pedestrian/bicycle crossing at McCreary Drive and Knoles Drive intersection.</li> <li>Frequent traffic back-ups due to high pedestrian and bicycle crossings.</li> <li>Busy parking facility near University Union Fieldhouse.</li> <li>3 crashes were reported that include bicycle-pedestrian and vehicle-pedestrian.</li> <li>Narrow sidewalk in front of Cline Library.</li> <li>2015 LSMP recommended Fieldhouse parking lot improvement to improve pedestrian walkability through the parking lot (project C6).</li> </ul>	7

Location ID	Location Description	Need Type	Needs Description	Prioritization Rating
13	Central Campus; University Union Food Court area to McCreary Drive	Connection Need	Heavy pedestrian, bicycle, and skateboard interactions.	-
14	Central Campus; San Francisco Street and McCreary Drive	Spot Need	<ul style="list-style-type: none"> <li>• A traffic signal was constructed at this intersection in 2016.</li> <li>• 2 crashes reported that involved a vehicle-pedestrian and vehicle-bicycle crash.</li> <li>• Frequent back-ups at San Francisco Street and McCreary Drive intersection due to high pedestrian crossing volumes.</li> </ul>	-
15	North Campus; Beaver Street and Franklin Avenue	Spot Need	<ul style="list-style-type: none"> <li>• 2 crashes were reported; one includes bicycle/pedestrian.</li> <li>• Franklin Avenue has narrow sidewalks.</li> <li>• The intersection has high interaction between vehicles, pedestrians, and bicycles.</li> </ul>	-
16	North Campus; Beaver Street and Dupont Avenue	Spot Need	<ul style="list-style-type: none"> <li>• The 2015 LSMP recommends a project to enhance the entrance at Beaver Street and Dupont Avenue by improving the pedestrian experience (Project N4).</li> </ul>	-
17	North Campus; Dupont Avenue and Humphreys Street	Spot Need	<ul style="list-style-type: none"> <li>• 1 crash reported that involved a vehicle-bicycle.</li> <li>• Bicyclists and pedestrians are walking through loading dock on Humphrey Street north of Dupont Avenue with no sidewalk.</li> </ul>	-
18	North Campus; Dupont Avenue between North Union and North Hall	Spot Need	<ul style="list-style-type: none"> <li>• Heavy parking activity at High Country Conference Center Parking Structure.</li> <li>• The crosswalks were identified by stakeholders as having issues near the Drury Hotel.</li> </ul>	-
19	North Campus; Butler Avenue and Humphreys Street	Spot Need	<ul style="list-style-type: none"> <li>• Pedestrians find it difficult to use the existing Circular Flashing Rapid Beacon (CFRB) is difficult to be seen by pedestrians using the crossing; consider improving to a Pedestrian Hybrid Beacon.</li> </ul>	-
20	Central Campus; Riordan Ranch Street and Riordan Road	Spot Need	<ul style="list-style-type: none"> <li>• Riordan Road and Milton Road intersection constructed at a skew, making it awkward for bicyclists and pedestrians to navigate.</li> </ul>	-

## 6. Recommendations

Based on the evaluation of current walking and bicycling conditions at NAU, input from the stakeholder's interviews, results of the student/faculty survey, and the TAC needs prioritization exercise, a series of on-campus and off-campus bicycling improvements are recommended.

The recommended improvements draw upon national best practices for multimodal facility design, as well as recommendations from other recent studies such as the NAU LSMP and the Flagstaff Regional Active Transportation Plan.

### 6.1 ON-CAMPUS PROJECT RECOMMENDATIONS

On-campus recommendations are organized into six focus areas and consist of 15 individual projects. The five focus areas collectively include the highest-priority needs as identified in **Table 3**. Lower priority needs, that are in proximity to the focus areas, are also addressed. The focus areas are:

1. **Focus Area 1:** Campus Streets Bicycle Lanes
2. **Focus Area 2:** McConnell Drive: I-17 to Knoles Drive; Pine Knoll Drive: McConnell Drive to Huffer Lane
3. **Focus Area 3:** San Francisco Street: Mountain View to Pine Knoll Drive, and Pine Knoll Drive
4. **Focus Area 4:** South Campus "Pedway": P62 Parking Lot to Walkup Sky Dome
5. **Focus Area 5:** Knoles Drive: University Drive to McConnell Drive
6. **Focus Area 6:** Central Campus; Blome Drive (near Raymond Hall): Knoles Drive to NAU Trail/Pedway

#### *Facility Recommendations*

Project recommendations were developed considering:

- A need to separate users (bicyclists, pedestrians, skateboarders) from operating in the same space. Each user operates at different speeds; providing facilities for each improves safety and comfort.
- Shared use paths, pedways, and cycle tracks are the ideal separated facilities. Constructing these facilities will be most effective in attracting larger numbers of staff and faculty to ride a bicycle to and around campus.
- On-street improvements are still required to meet the needs of faster-moving bicyclists who are comfortable riding in on-street bicycle lanes. Bicycle lanes also help to traffic-calm vehicular

### Separated Bicycle Facilities

Separated bicycle facilities or protected bikeways are important to attract a larger number of bicyclists traveling to and from campus. Shared use paths and cycle tracks are examples of separated facilities.

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used for bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks (Source: NACTO)

#### Two-Way Cycle Track



#### Shared Use Path



traffic, encouraging drivers to comply with the 15 mph and 25 mph campus speed limits.

*NAU Multimodal Assessment* recommendations include the following:

**Separated Shared Use Paths:** New shared use paths or cycle tracks are recommended to improve east-west and north-south connectivity. As evidenced by the community survey, students and faculty desire comfortable and convenient bicycle and pedestrian facilities that are separated from vehicular traffic. Surveys completed in other cities in the United States show that a common reason that people do not ride bicycles, for commuting purposes, is because they are concerned about being in the roadway on a bicycle – they fear being injured or killed in a crash with a motor vehicle.

**On-Street Bicycle Lanes:** While NAU has an extensive system of shared use paths adjacent to campus roadways such as the pedway and shared use paths adjacent to San Francisco Street and Knoles Drive, the facilities serve pedestrians/skateboards, and bicyclists all within the same space. Users desire that separate facilities be provided for bicyclists and pedestrians. On-street bicycle lanes are needed to separate higher-speed bicycle traffic from slower-speed pedestrian traffic and skateboarders.

On-street bicycle lanes serve two purposes: 1) provide a facility for bicyclists who prefer to ride faster than pedestrians and skateboards on the shared use paths, 2) narrow the travel lane width, which helps to slow vehicle speeds as they perceive the narrower roadway width.

**Shared Lane Markings:** In cases where campus streets are too narrow for designated bicycle lanes, Shared Lane Markings (SLMs) are recommended in the interim, to be placed in the travel lane to indicate where the bicyclists should preferably cycle, and to alert motorists of the position bicyclists are likely to occupy in the traveled way.

Recommended projects are listed in **Table 3**.

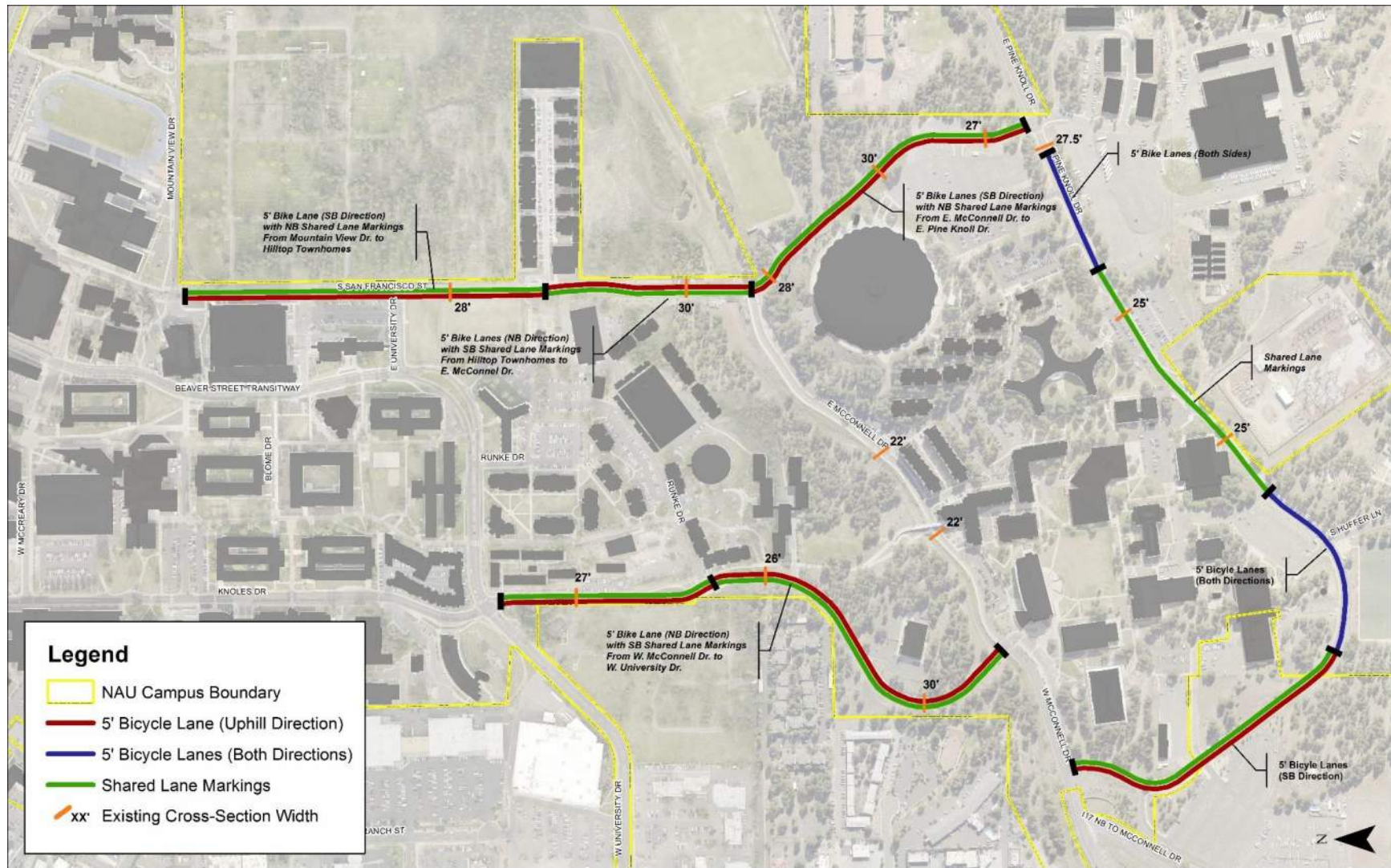


Table 3. Focus Area 1, Campus Streets Bicycle Lanes

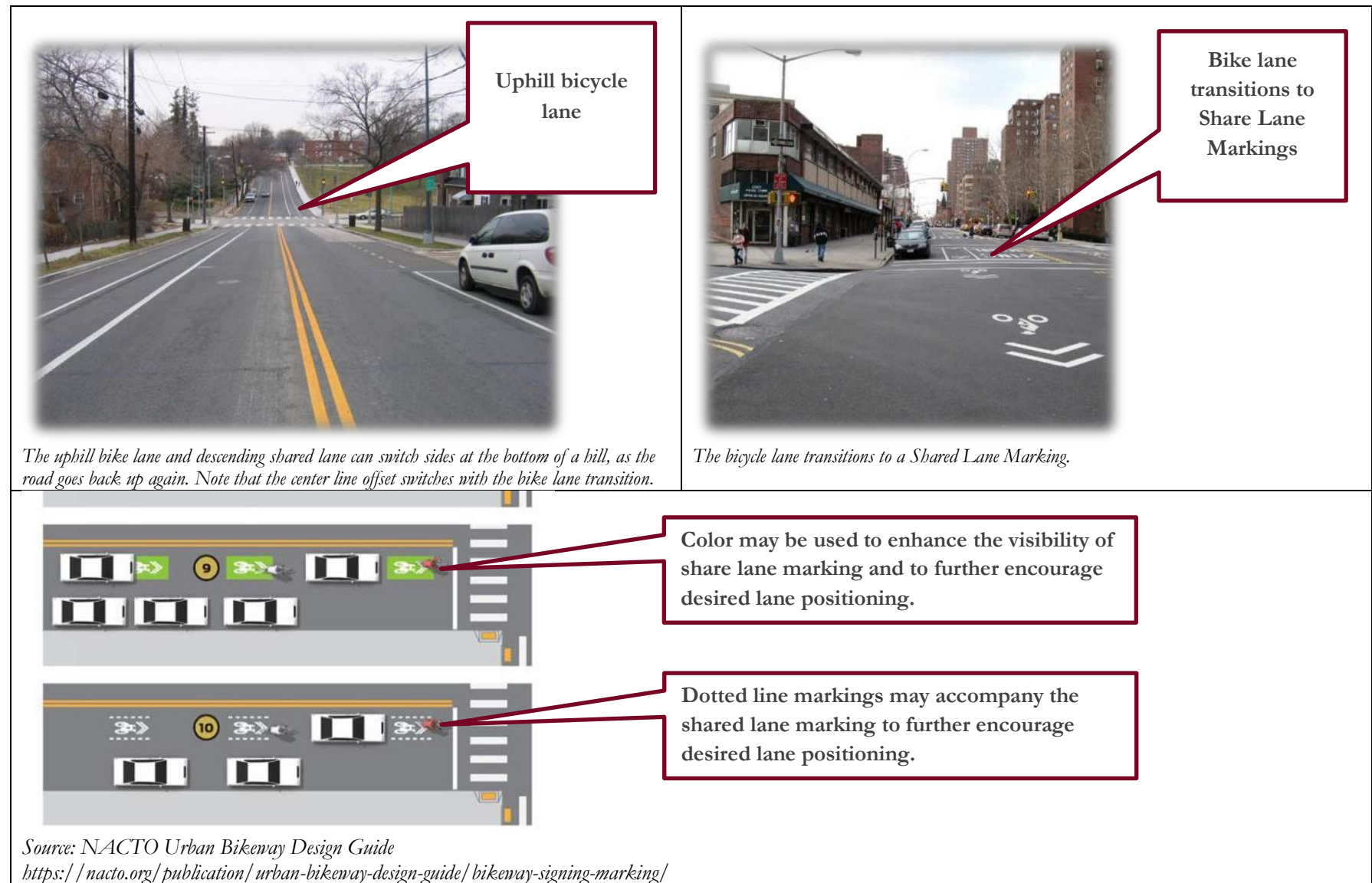
Project Number	Recommendation	Improvement Type	Cost	Description
1	On-Street Bicycle Lanes: San Francisco Street, Pine Knoll Drive, Knoles Drive	Bicycle	<b>\$160,000</b>  Costs include a slurry seal prior to application of new striping.	<p>It is recommended that on-street bicycle lanes be installed on primary campus streets. The preferred minimum width for a bicycle lane is 5 feet when adjacent to a curb, inclusive of gutter pan (AASHTO Guide for the Development of Bicycle Facilities). City of Flagstaff Engineering Detail 10-09-035 includes a 4.5' bike lane exclusive of the gutter pan, which, inclusive of the gutter plan, increases the bike lane width to 6.5' from face of curb.</p> <p>Where sufficient width is not available for bicycle lanes on both sides of the street, as an interim improvement, bicycle lanes are recommended on one side of the road only (in the uphill travel direction) and shared lane markings (SLMs) installed on the downhill side of the road. <b>Figure 3</b> shows an illustration of SLMs. The transition from a SLM to a bicycle lane, or vice versa, should include sufficient taper to avoid vehicles or bicycles from making sudden shifts/maneuvers. Transition and shifts should be gradual. Shared lane marking may include a green backing, as illustrated in <b>Figure 5</b>.</p> <p>Over the long-term, bicycle lanes should be constructed on both sides of campus streets, in place of shared lane markings as illustrated in <b>Figure 6</b>. The ultimate/long-term cross-section should also include a separated Pedway where feasible.</p> <p><b>Figure 7</b> to <b>Figure 13</b> illustrate cross-sections with bicycle lanes and shared lane markings. Ultimate long-term cross-sections are also shown.</p>



**Figure 3.** Shared Lane Markings  
*Source: NACTO*

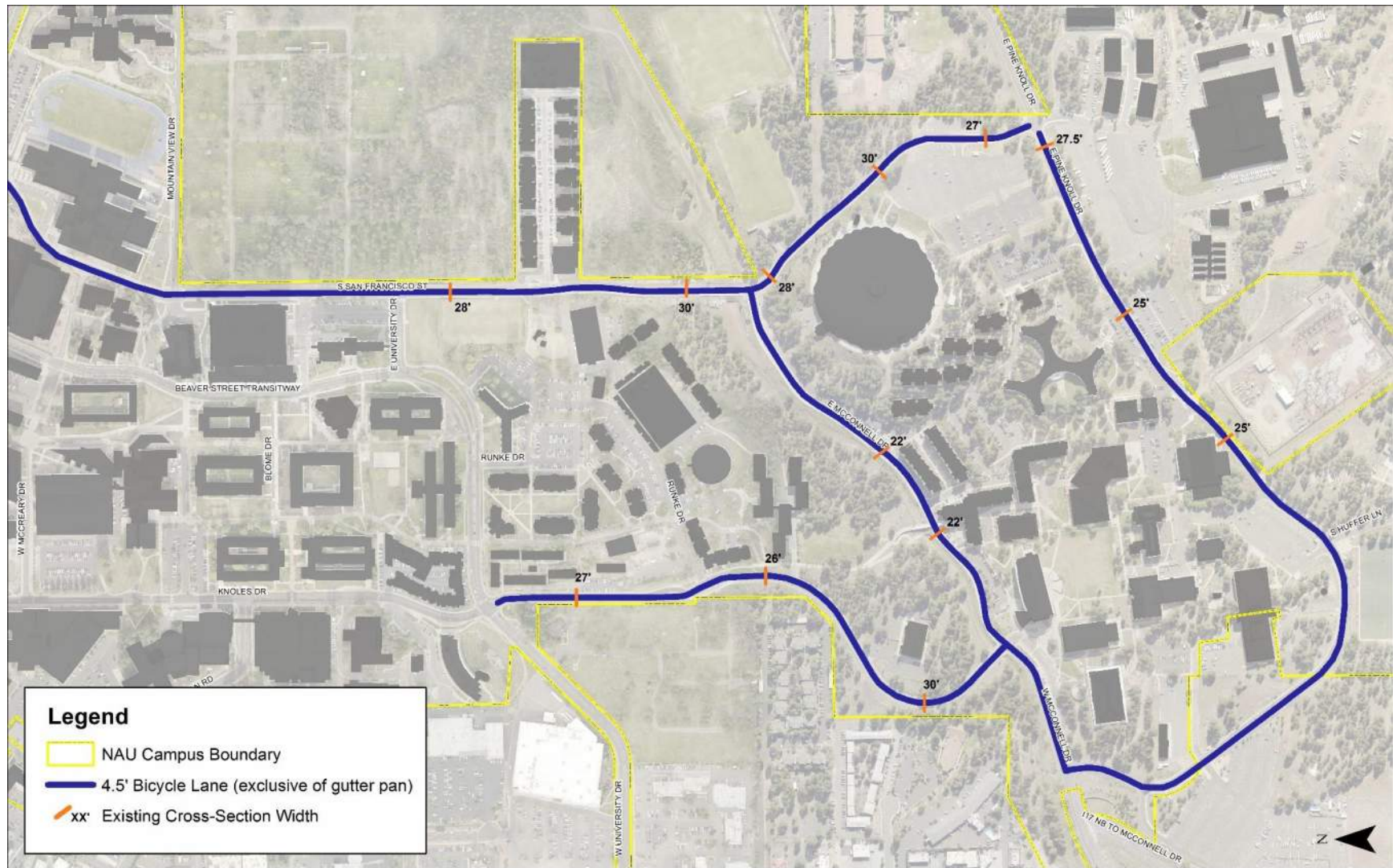


**Figure 4.** Bicycle Lanes and Shared Lane Markings: San Francisco St., Pine Knoll Dr., Knoles Dr.



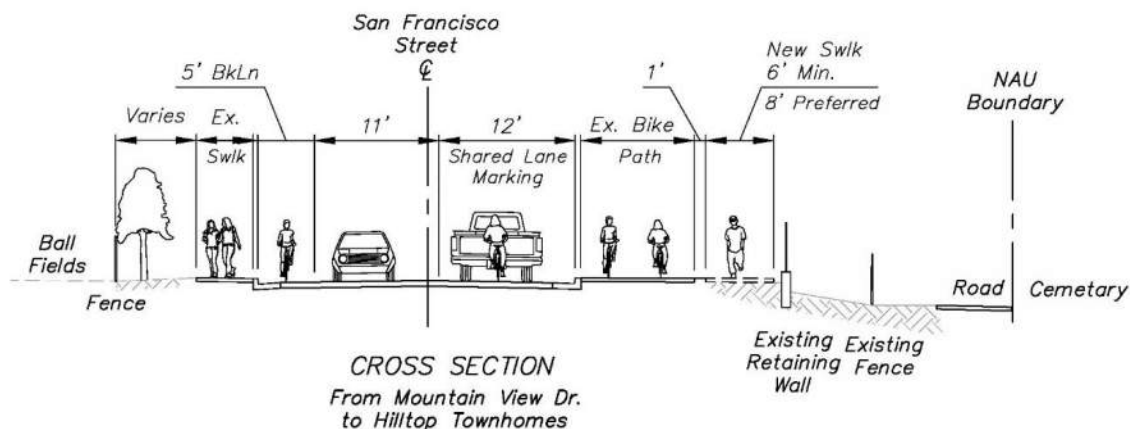
**Figure 5.** Examples of uphill Bike Lanes and Shared Lane Markings



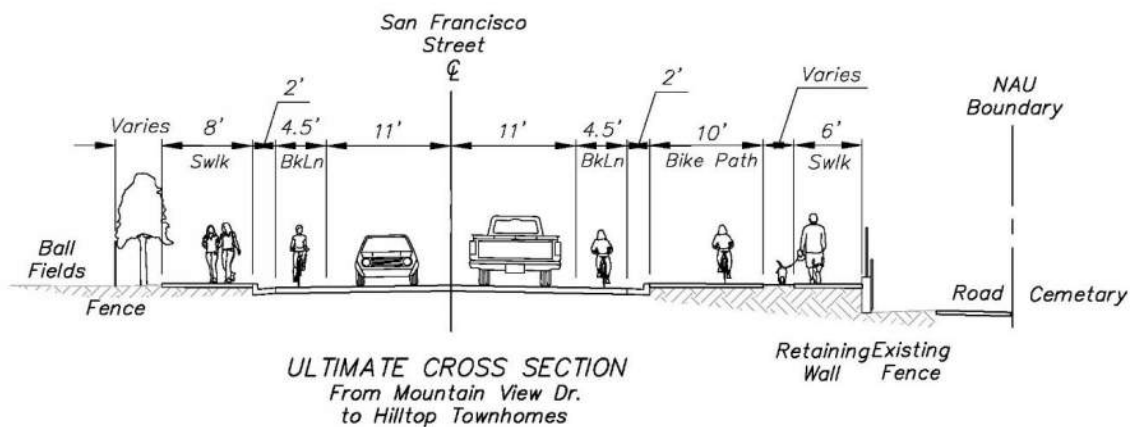


**Figure 6.** Long-Term / Ultimate Cross-Section Bicycle Lanes.

*Interim Cross-Section*

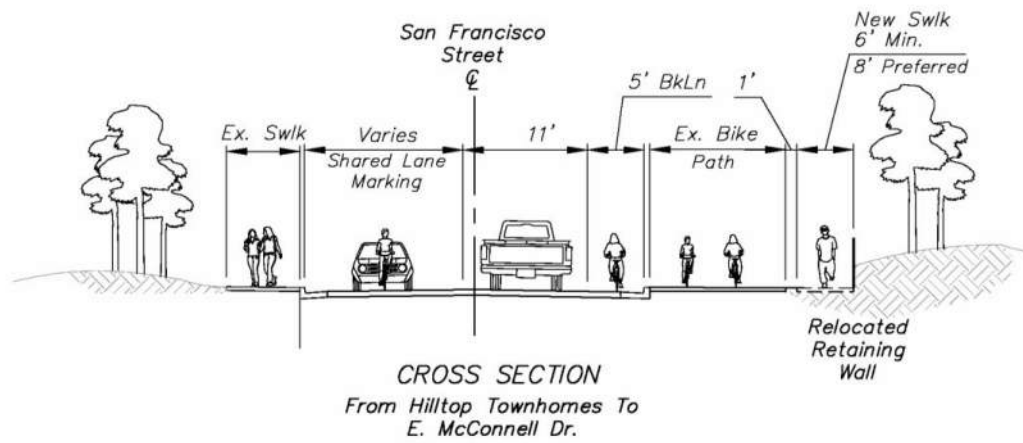


*Long-Term/Ulimate Cross-Section*

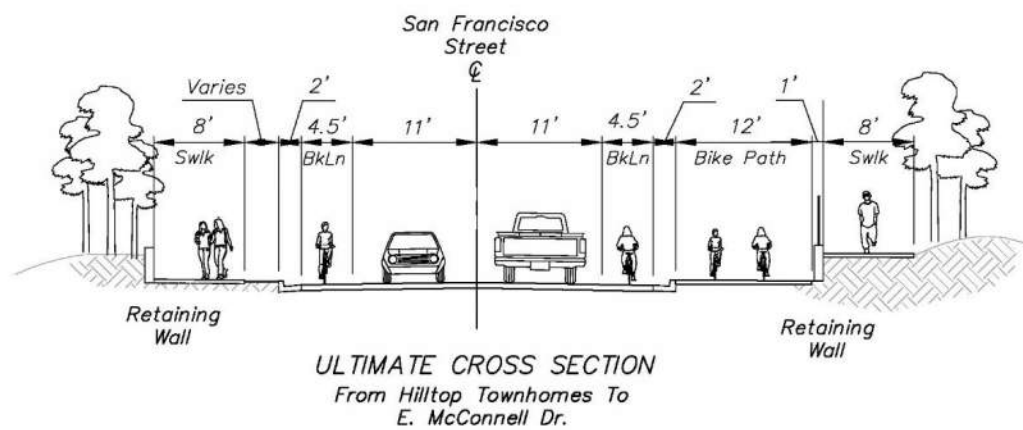


**Figure 7.** Proposed Cross-Sections: San Francisco Street: Mountain View to Hilltop Homes

*Interim Cross-Section*

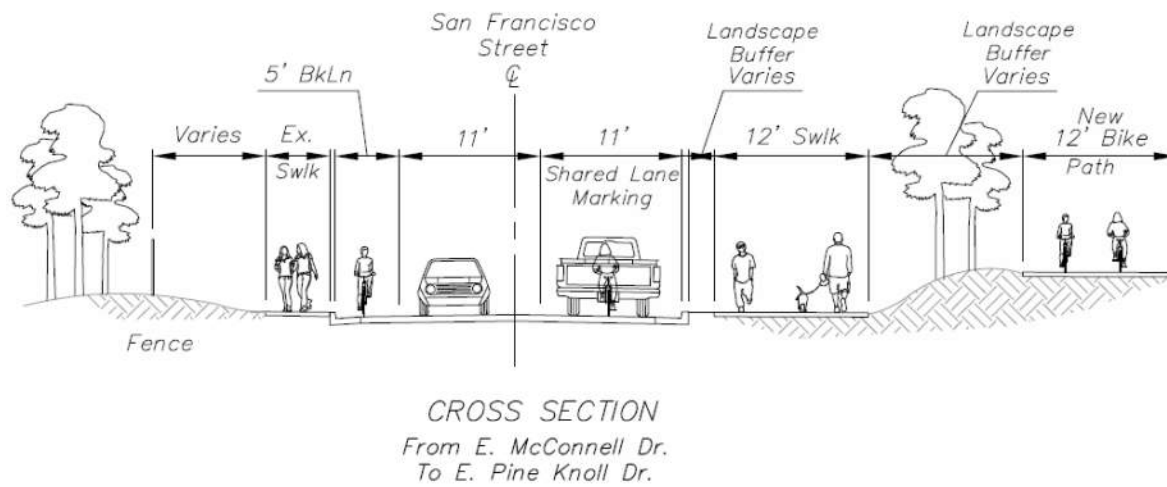


*Long-Term/Ultimate Cross-Section*

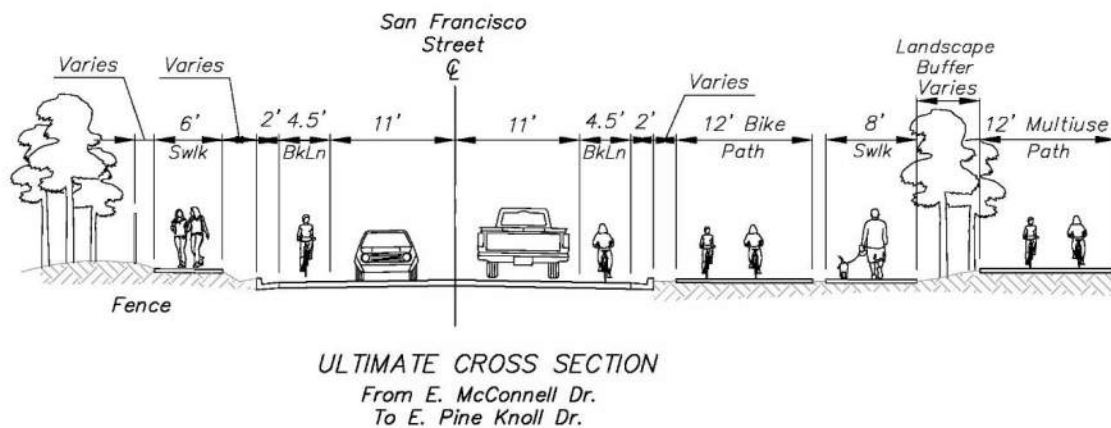


**Figure 8.** Proposed Cross-Sections: San Francisco Street: Hilltop Homes to McConnell Dr.

*Interim Cross-Section*



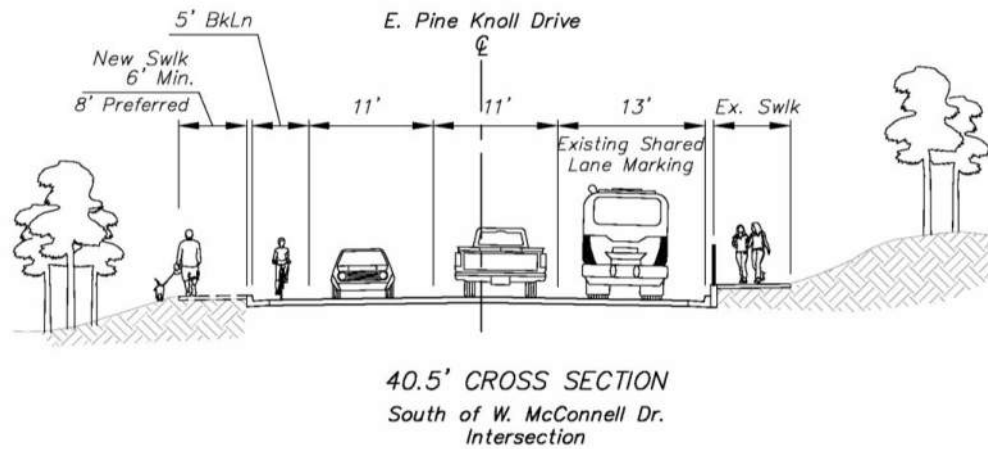
*Long-Term/Ulimate Cross-Section*



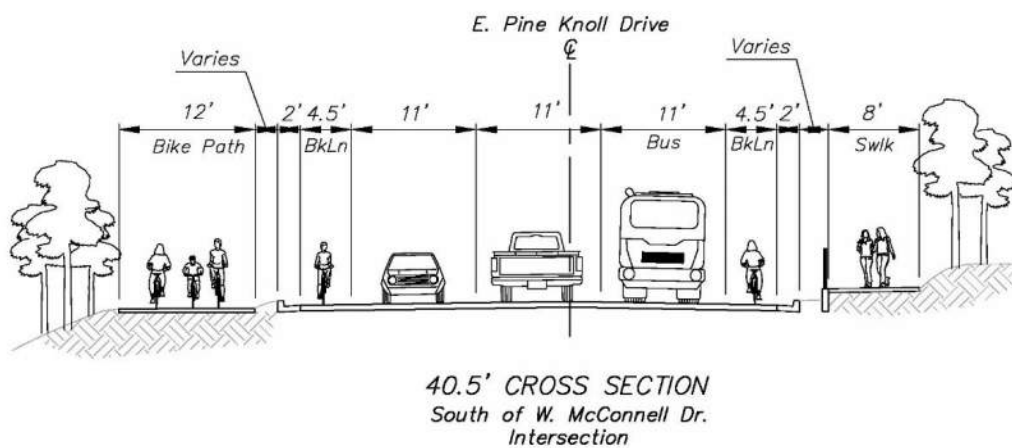
**Figure 9.** Proposed Cross-Sections: San Francisco Street: McConnell Dr. to Pine Knoll Dr.



*Interim Cross-Section*

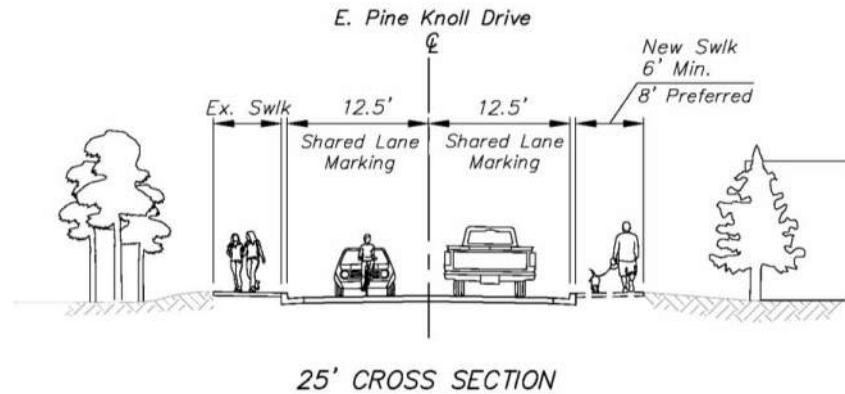


*Long-Term/Ultimate Cross-Section*

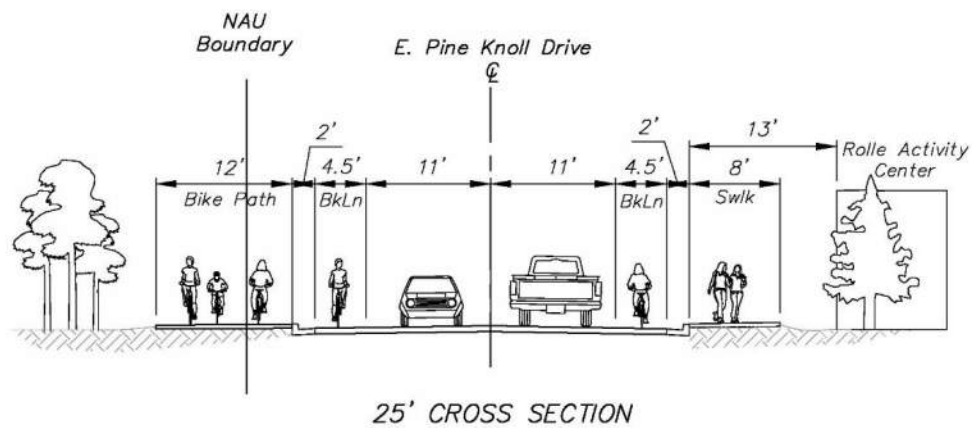


**Figure 10.** Proposed Cross-Sections: Pine Knoll Dr.: South of McConnell Dr. Intersection

*Interim Cross-Section*

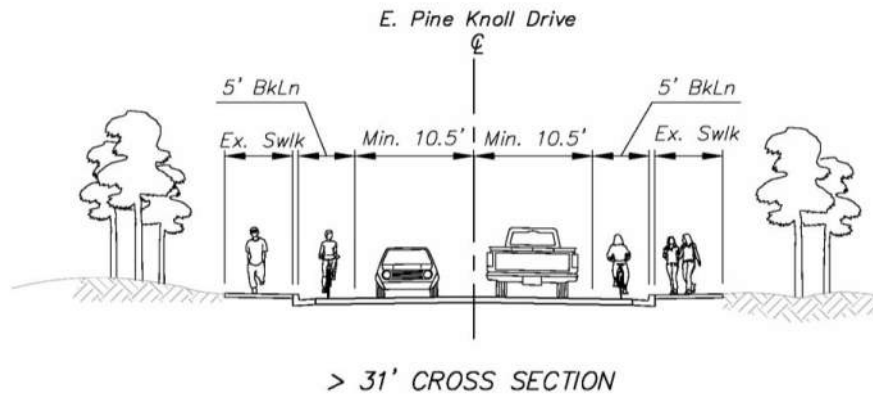


*Long-Term/Ultimate Cross-Section*

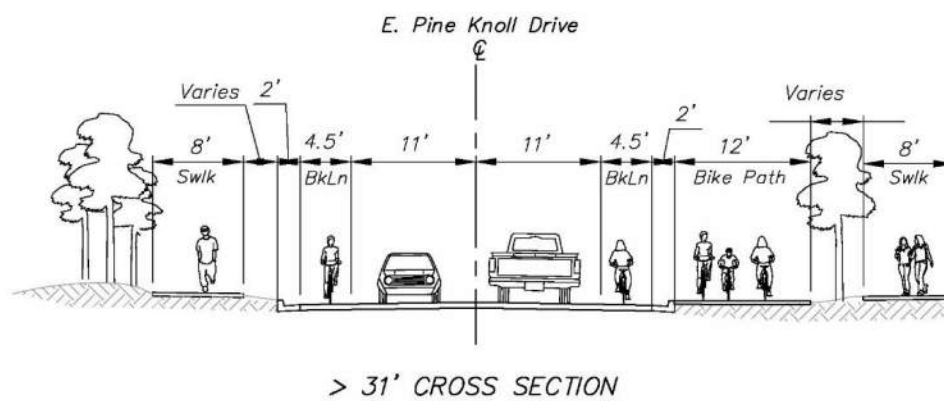


**Figure 11.** Proposed Cross-Sections: Pine Knoll Dr.: 25' Cross-Section

*Interim Cross-Section*

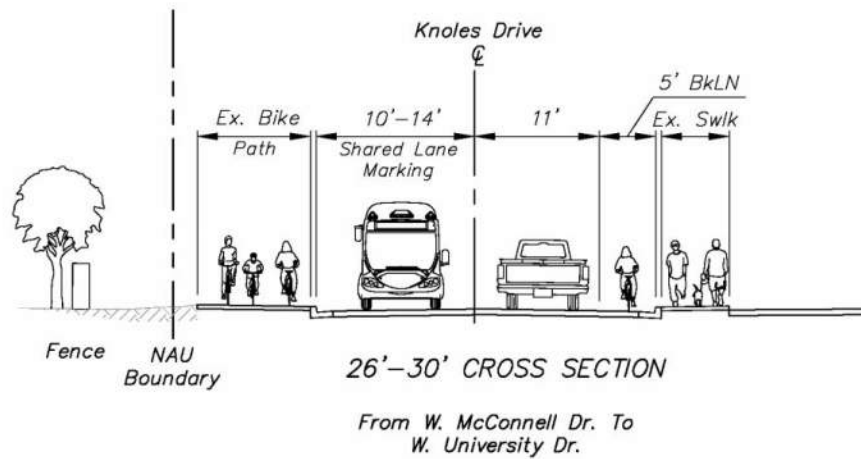


*Long-Term/Ulimate Cross-Section*

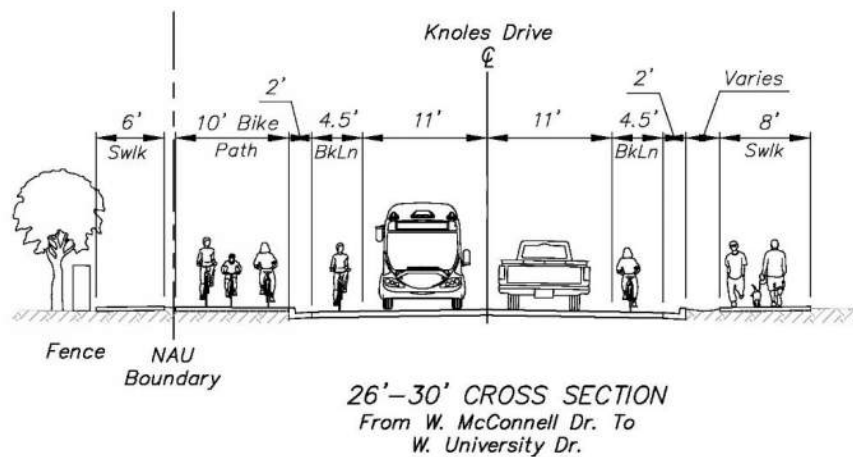


**Figure 12.** Proposed Cross-Sections: Pine Knoll Dr.: 31' Cross-Section

*Interim Cross-Section*



*Long-Term/Ultimate Cross-Section*



**Figure 13.** Proposed Cross-Section: Knoles Drive, McConnell Drive to University Drive

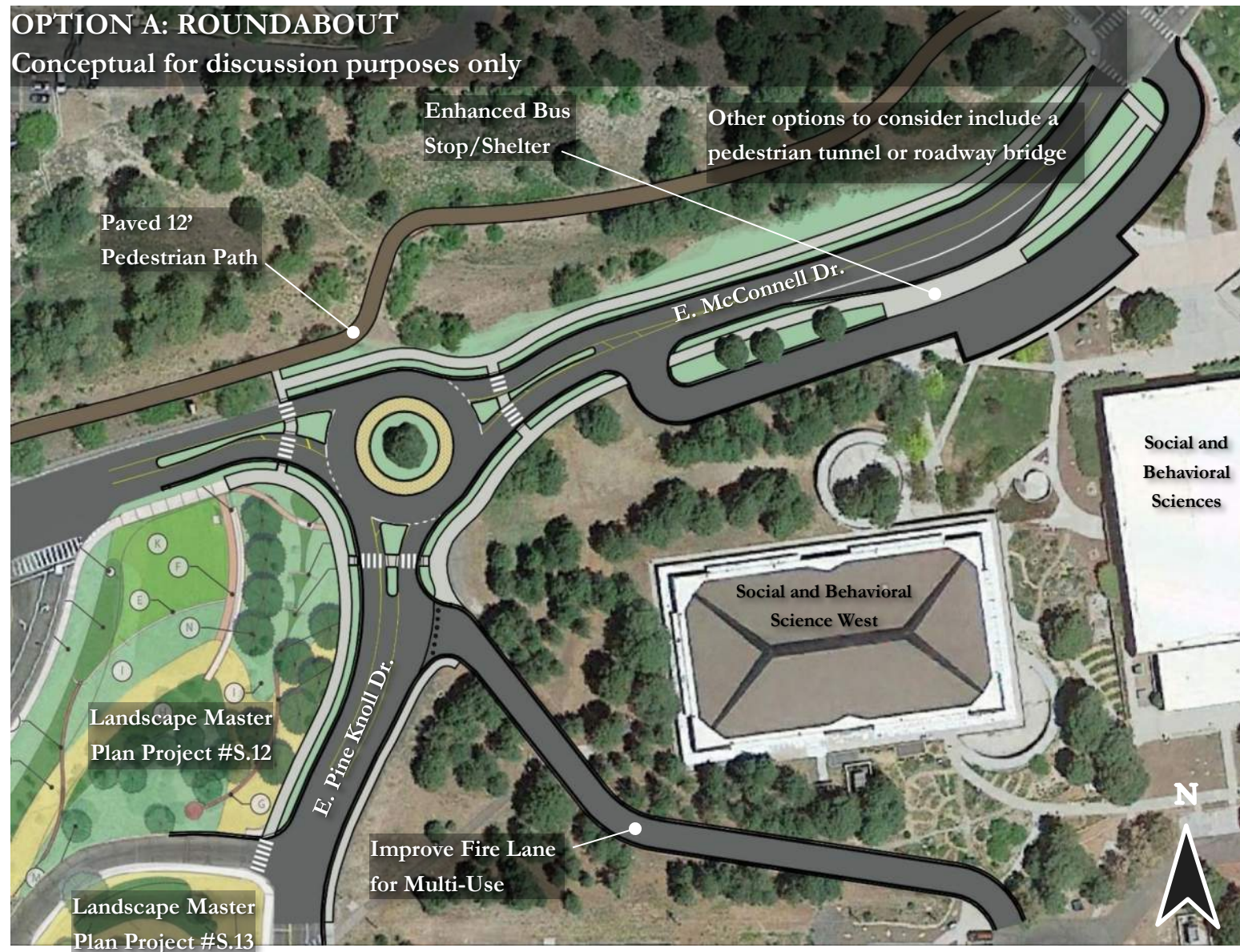
Table 4. Focus Area 2, McConnell Dr.: I-17 to Knoles Dr.; Pine Knoll Dr. – McConnell Dr. to Huffer Lane

Project Number	Recommendation	Improvement Type	Cost	Description
2	<p>McConnell Road Enhancements:</p> <ul style="list-style-type: none"> <li>• Realign McConnell Road to the south</li> <li>• Construct a single lane roundabout at the intersection of McConnell Dr. and Pine Knoll Dr.</li> <li>• Add sidewalk to the north side of McConnell Drive.</li> <li>• Add sidewalk to both sides of Pine Knoll, from McConnell to Huffer Lane (near P47/P62).</li> <li>• Improve Behavioral Sciences fire access road for pedestrians.</li> <li>• Bus stop / pullout improvements.</li> </ul>	Pedestrian / Bicycle	Multiple alternatives are provided; this area is subject to an on-going feasibility study which will select a preferred alternative, and detailed cost estimate.	<p>A roundabout was identified in the NAU Campus Traffic and Circulation Study (2013). A roundabout would (<b>Figure 14</b>, Option A) provide traffic calming benefits and efficient movement through the intersection.</p> <p>A T-intersection (<b>Figure 15</b>, Option B) would include a traffic signal to control traffic for pedestrian crossings. “Barn dance” signal timing may be considered (includes a pedestrian phase in which all pedestrians cross both legs of the intersection simultaneously). Detailed traffic operations analysis is required.</p> <p>Other suggested ideas are a pedestrian tunnel or roadway bridge under McConnell to eliminate at-grade crossings.</p>
3	Pave Sinclair Wash Trail from “The Suites” to Milton Road, approximately 0.3 miles.	Pedestrian/ Bicycle	<b>\$110,000</b>	Paving the Sinclair Wash Trail would provide an “all weather” pathway that is off-set from McConnell Road.
4	Construct sidewalks on south side of Pine Knoll Drive from Huffer Lane (P62) to Huffer Lane (P46).	Pedestrian	<b>\$170,000</b>	Several segments of Pine Knoll Drive have sidewalk gaps. Upon implementation, sidewalks will be continuous between McConnell Drive and San Francisco Street.
5	Implement LSMP Project S.13, McConnell Entry Parking Lot: reconfigure and improve McConnell entry to P62 to enhance and accommodate pedestrian/bicycle movements	Pedestrian/ Bicycle	<b>Per LSMP</b>	Consider a configuration as recommended in the <u>2015 Landscape Master Plan, Concept Design S13</u> . Also consider LSMP S.12 (Entry Monument) as depicted in <b>Figure 14</b> and <b>Figure 15</b> (LSMP, Project S12 and S.13); a larger image of S.13 is included in <b>Figure 16</b> .



## OPTION A: ROUNDABOUT

Conceptual for discussion purposes only

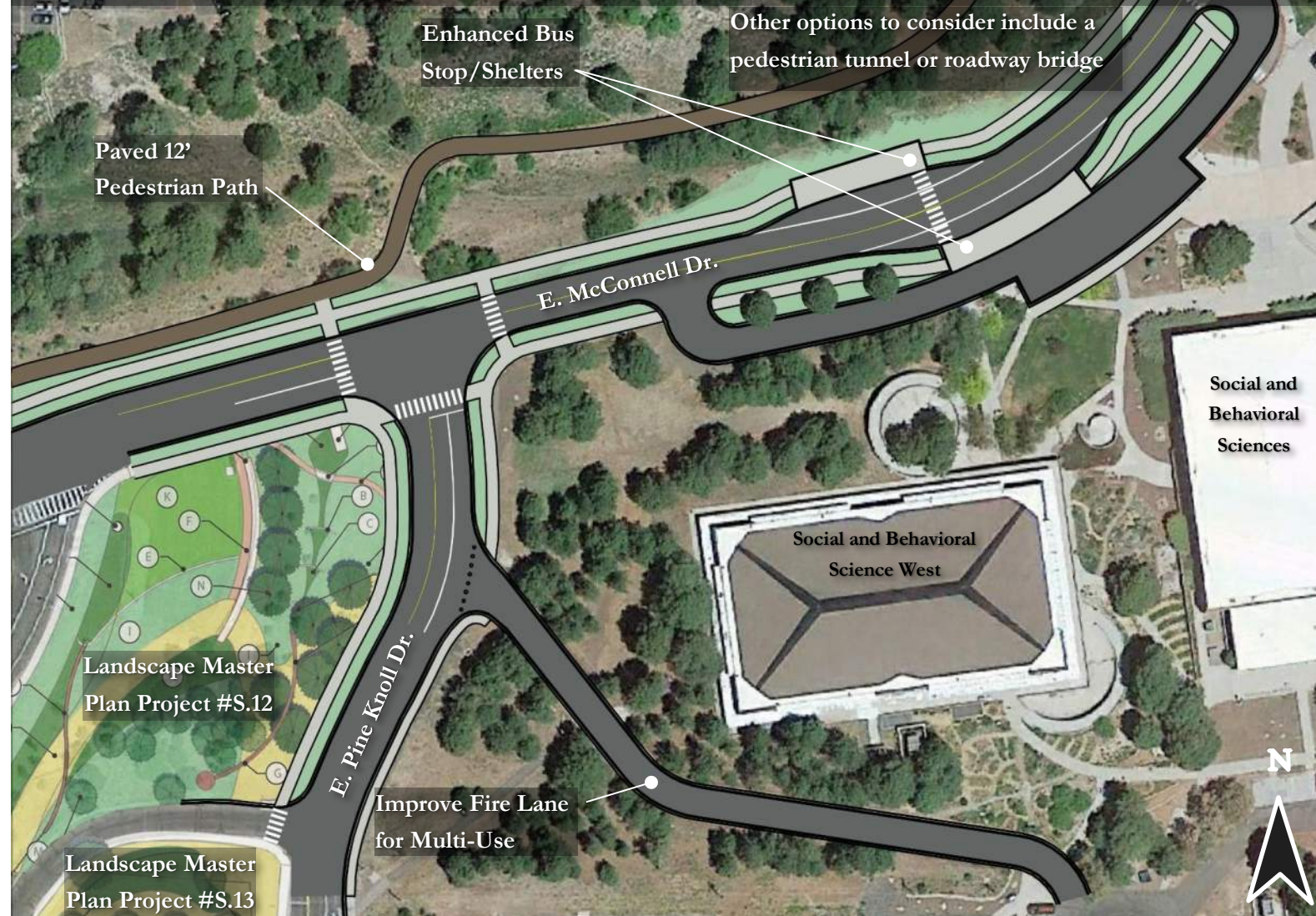


**Figure 14.** Project #2, #3, and #5 - McConnell Road / Pine Knoll Drive Improvements, Roundabout Option



## OPTION B: T-INTERSECTION

Conceptual for discussion purposes only



**Figure 15.** Project #2, #3, and #5 - McConnell Road / Pine Knoll Drive Improvements, Signalized Intersection Option



## MOUNTAIN SOUTH CAMPUS: CONCEPT DESIGNS

### S13. MCCONNELL ENTRY PARKING LOT



#### LEGEND



The following legend is a general guide unless keynoted otherwise with more specific conditions  
\*(Refer to Principles and Design Standards)

- A. Plaza, concrete paving, sand finish, NAU logo sandblasted w/ color stain
- B. 18" high concrete retaining wall, sand finish w/ pre-cast cap\*
- C. PLD (Porous Landscape Detention) with native riparian shrubs and accent perennials
- D. Passenger drop off
- E. Parking lot reconfigured and re-striped to gain landscape islands, maintain existing space count
- F. 3' wide soil rip-rap drainage swale planted with Switchgrass
- G. Planting bed with native shrubs and perennials\*
- H. Short grass meadow mix\*
- I. Tall grass meadow mix\*
- J. Lawn\*
- K. Concrete walk light broom finish\*
- L. Maintain existing trees
- M. Ponderosa Pines\*
- N. Deciduous shade trees\*
- O. New curb and gutter islands
- P. Existing parking lot to remain
- Q. Maintain tractor trailer turning radius needed for emergency parking during I-40 snow closures

Figure 16. Project #5- LSMP Project S.13, McConnell Entry Parking Lot

Table 5. Focus Area 3 – Pine Knoll and San Francisco Street Improvements

Project Number	Recommendation	Improvement Type	Cost	Description
6	Improve San Francisco Street from Pine Knoll Drive to Mountain View Drive to include sidewalks, shared use path, and bike lane.	Pedestrian/ Bicycle	<b>\$575,000</b>	The proposed cross-section will include on-street bike lanes and off-set sidewalk that separates pedestrians and bicyclists. <b>Figures 7, 8, and 9</b> illustrate the proposed cross-sections for San Francisco Street, Mountain View to McConnell.
7	Implement an enhanced (with flashers/pedestrian signal) pedestrian crossing at the Hilltop Townhomes access drive.	Pedestrian/ Bicycle	<b>\$75,000</b>	Enhanced crossing alternatives include a circular rapid flashing beacon (CRFB) or a post-mounted Pedestrian Hybrid Beacon (PHB), pedestrian-activated warning beacon, in-roadway warning lights, or pedestrian-activated flashing LEDs in the border of a warning sign.
8	Improve Pine Knoll Drive from McConnell Drive to San Francisco Street to include sidewalks adjacent to street: a) Pine Knoll Drive, Huffer Lane Rolle Activity Center / P45 to San Francisco Street. b) Gap adjacent to P66 on north side of Pine Knoll, west of San Francisco Street. c) Pine Knoll / San Francisco Street to Facility Services	Pedestrian / Bicycle	<b>\$155,000</b>	The street width of Pine Knoll varies between McConnell Drive and San Francisco Street. <b>Figures 10, 11, and 12</b> illustrate cross-sections for each of the street widths.
9	McConnell and San Francisco Street Intersection and Connectivity Improvements <ul style="list-style-type: none"> <li>Improve shared use path at San Francisco and McConnell Drive: realign (flatten existing curve), provide an opening in guardrail to cross San Francisco Street.</li> </ul>	Pedestrian / Bicycle	<b>\$170,000</b>	<b>Figure 17</b> conceptually illustrates the improvements. Another option is to extend the FUTS trail across San Francisco Street at McConnell Drive: <b>Option A:</b> Tunnel at current FUTS (Sinclair Wash) alignment under San Francisco Street; <b>Option B:</b> Realign the FUTS trail to tie into the San Francisco Street and McConnell Drive intersection (shown in <b>Figure 17</b> ). Cost estimate does not include the FUTS trail extension.

Project Number	Recommendation	Improvement Type	Cost	Description
	<ul style="list-style-type: none"> <li>Install pedestrian crossing beacon (Circular Flashing Beacon) or a Pedestrian Hybrid Beacon at the McConnell/San Francisco intersection. Examples are illustrated below.</li> </ul>			
	 <p><i>Pedestrian Hybrid Beacon, mast-arm mounted</i> <i>Photo: City of Flagstaff</i></p>			 <p><i>Solar powered Pedestrian Hybrid Beacon, post-mounted</i> <i>Photo: <a href="http://elteccorp.com/warning_systems/hawk-hybrid-pedestrian-crosswalk/">http:// elteccorp.com/warning_systems/hawk-hybrid-pedestrian-crosswalk/</a></i></p>
10	Evaluate the demand for a new parking structure and transit center at P64 (Facility Services). [Note: current parking supply and utilization are not evaluated in this report, this location is suggested as an option to accommodate future parking needs when warranted].	Parking / Transit	Requires detailed analysis outside of the scope of this assessment.	A new parking structure located at the perimeter of campus will help to reduce traffic on campus roadways. This will enable additional interior surface lots to be closed, reducing the number of vehicles that drive on interior campus streets.





**Figure 17.** Project #9- McConnell Dr. and San Francisco St. Intersection and Connectivity Improvements



Table 6. Focus Area 4 – South Campus “Pedway”, P62 Parking Lot to Walkup Sky Dome

Project Number	Recommendation	Improvement Type	Cost	Description
11	Implement a continuous Pedway from P62 / Pine Knoll Drive to the Walkup Skydome.	Pedestrian/ Bicycle	<b>\$1,200,000</b>	<p>Currently, a series of sidewalks, plazas, and pathways provide fragmented connectivity P62 and the Skydome. A continuous east-west Pedway is needed to connect P62 Parking Lot, Walkup Skydome, and intermediate destinations.</p> <p>The Pedway will clearly direct pedestrians and bicycle traffic from the P62 parking lot to the Skydome. Existing pavement within this segment would be reconstructed to be consistent with NAU Pedway signing, marking, and hardscape treatments.</p> <p>See <b>Figure 18</b> for a potential route.</p> <p>Reference the <i>2015 Landscape Master Plan (S.7)</i> for specific treatment at the Skydome.</p>

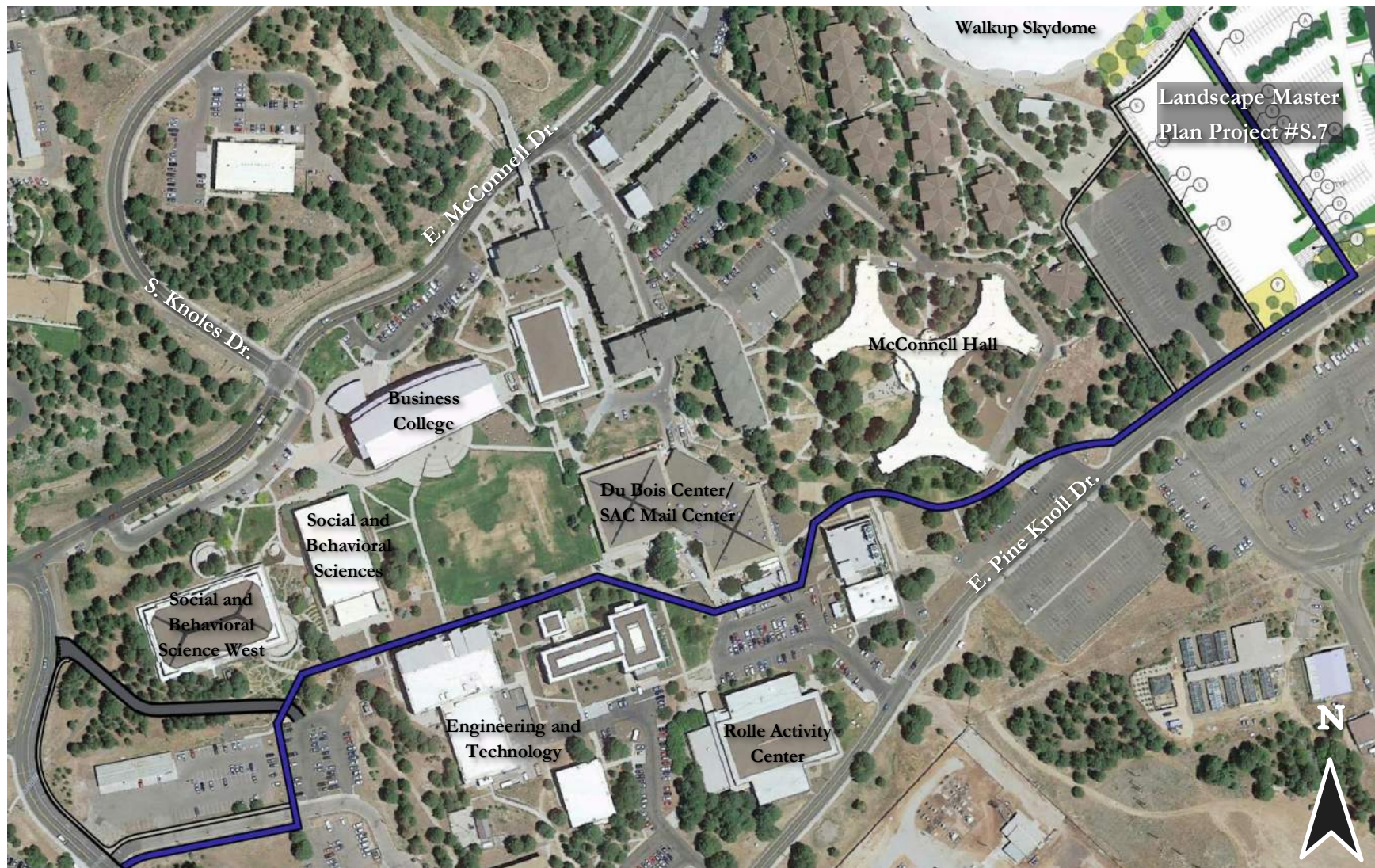


Figure 18. Project #11- South Campus Pedway, P62/Pine Knoll to Walkup Skydome

Table 7. Focus Area 5 – Knoles Drive, University Drive to McConnell Drive

Project Number	Recommendation	Improvement Type	Cost	Description
12	Knoles Drive improvements: new sidewalk adjacent to existing shared use path on west side of Knoles Drive, from McConnell to University Drive.	Pedestrian	<b>\$255,000</b>	<b>Figure 4</b> illustrates limits of bicycle lanes and shared lane markings, and <b>Figure 13</b> illustrates proposed cross-sections. Due to constrained street width, bicycle lanes are constructed in the uphill direction only. Shared lane markings (SLMs) are installed in the downhill side direction.
13	Construct sidewalks on southside of Runke Drive from Knoles Drive to the P33A parking lot	Pedestrian	<b>\$50,000</b>	Sidewalks following the profile of the roadway. Utilities may require relocation.
14	Runke Drive to San Francisco Street Pedway; provide a shared use path/walkway from Hilltop Townhomes (San Francisco Street) connecting to University Drive.	Pedestrian / Mobility	<b>\$435,000</b>	See <b>Figure 19</b> for a potential route for a Pedway to connect San Francisco Street to University Drive.



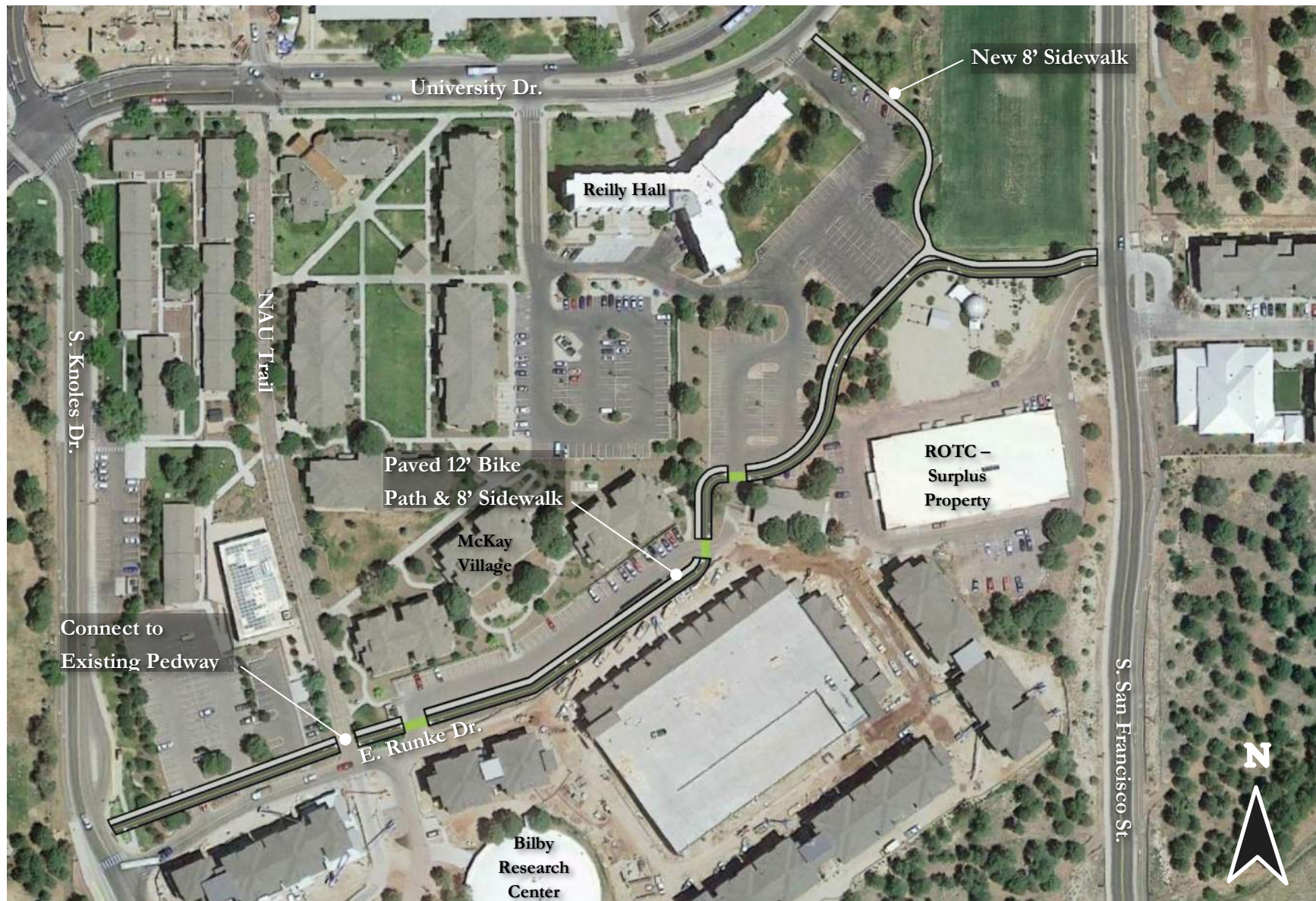


Figure 19. Project #14- Runke Drive to San Francisco Street Pedway

Table 8. Focus Area 6 – Central Campus; Blome Dr. (near Raymond Hall), from Knoles Dr. to NAU Trail/Pedway

Project Number	Recommendation	Improvement Type	Cost	Description
15	<p>Knoles Restricted Access (to bicycles, pedestrians, and transit only) during school hours, Knoles to Transitway Pedway</p> <ul style="list-style-type: none"> <li>• Close interior surface parking lots P16 and P16A. Direct parking customers to other parking garages or perimeter surface lots (e.g. P13). Evaluate demand for a new parking structure on P13 to meet parking demand, or adding levels to the Knoles Parking Garage.</li> <li>• Install closure gates on Knoles Drive, Riordan Road to McCreary Drive (south of P8) to preclude vehicular traffic. Could also consider peak period only closure (7:30 am – 4:30 pm). Allow access (via gate) to delivery and maintenance vehicles only.</li> <li>• Install new pedway from Knoles Drive to Transitway, with streetscape and way-finding</li> </ul>	Pedestrian and Bicycle	<b>\$325,000</b>	<p>Removal of interior central parking lots will reduce traffic on Knoles Drive. Note that the <i>2015 Landscape Master Plan</i> provides an enhancement opportunity for the Field House Parking Lot (P16A), project C6.</p> <p>New pedway will provide east-west connectivity between Knoles Drive and Transitway.</p> <p>Removal of vehicular traffic will connect the Cline Library to central campus.</p>



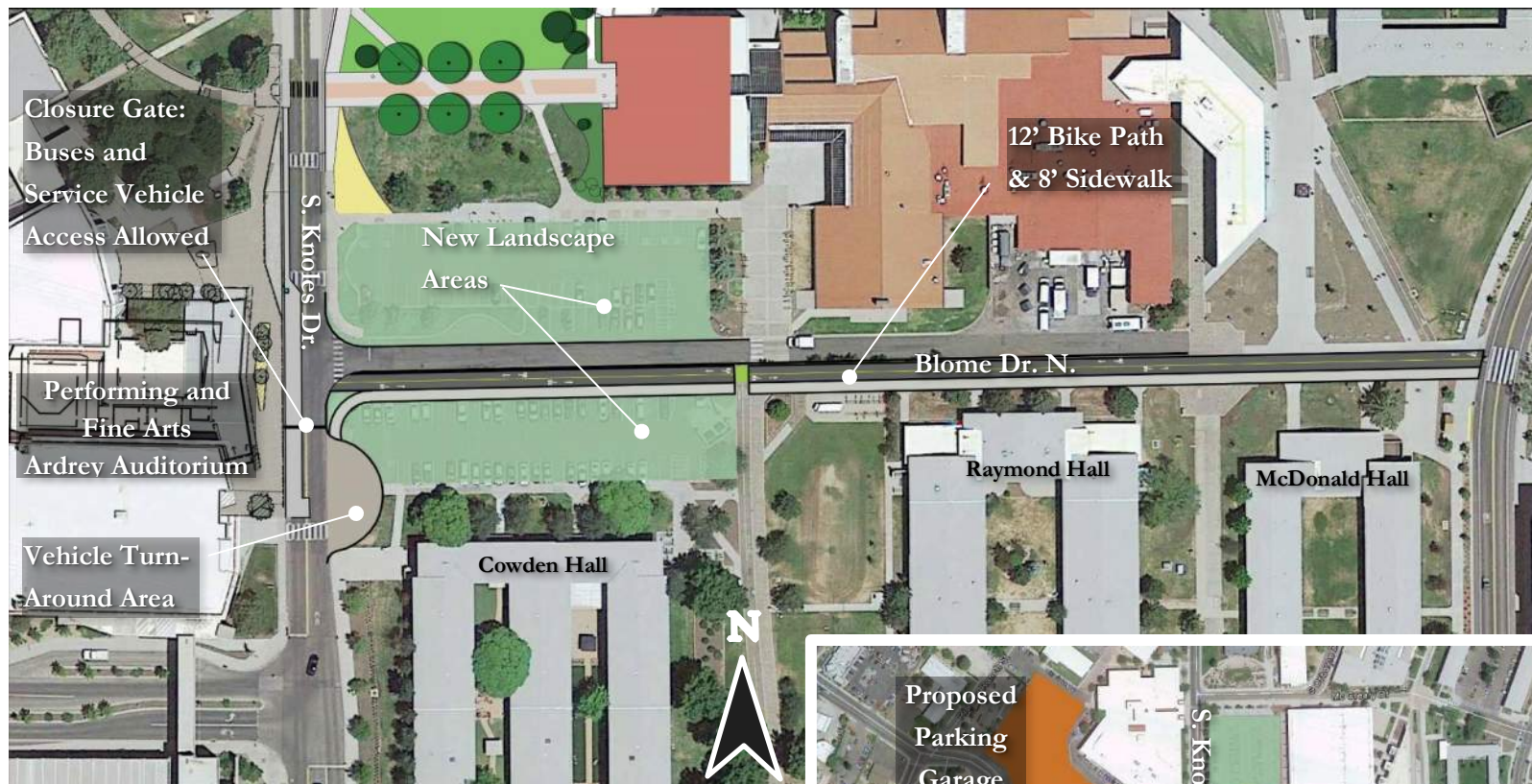


Figure 20. Project #15- Knoles Drive and Knoles to McCreary Pedway





## 6.2 OFF-CAMPUS RECOMMENDATIONS

The Flagstaff Alternative Transportation Plan includes project recommendations that will require the collaboration and support with NAU. The Active Transportation Plan recommends development and implementation of a “Pedestrian-Bicycle Super Highway” that is developed from a set of linear corridors that accommodate comfortable and safe cross-town travel for bicyclists and pedestrians. Collaboration with these regional projects is important to success of increasing the numbers of those walking and bicycling to NAU.

Four potential regional PedBikeWay corridors (Bicycle Super Highway) have been identified, as described in the Active Transportation Plan.

- **Milton:** facilitates access to campus, Downtown, and the Southside for neighborhoods to the south;
- **Downtown/Southside:** a direct path between the NAU campus and north/northwest neighborhoods;
- **Eastside:** crosstown route for pedestrians and bicyclists coming from east and northeast neighborhoods;
- **Westside:** connects western neighborhoods to the core area, and provides a way across Milton Road and the BNSF tracks.

**The Milton Pedway will require collaboration and cooperation with NAU to implement.** NAU should support implementation of this separated, comfortable facility to convey bicyclists and pedestrians along the Milton Road Corridor.

Detailed information about the Milton bicycle and pedestrian facility can be found at: <http://www.flagstaff.az.gov/3181/Active-Transportation-Master-Plan>. As described by the Plan, the pedway would run from University Heights Drive to Dupont Avenue, approximately 2 miles. The pedway will consist of a combination of paved Flagstaff Urban Trail System (FUTS) trails, protected cycle tracks, and sidewalks. Pedway segments near or on NAU campus are depicted in **Figure 21**. Segments 7-12 are on NAU campus.

## PEDESTRIAN-BICYCLE SUPER HIGHWAY

Pedestrian-bicycle superhighways are linear corridors for walking and biking that are...

Are comfortable, safe, appealing, and functional as possible for pedestrians and bicyclists;

Function as primary commuting routes and facilitate crosstown travel;

Provide a high level of service to and through the core area of Flagstaff, including Downtown, the Southside, and the NAU campus;

Serve as alternatives to walking or riding on major roads, and provide a way to get around/through congested areas that otherwise are difficult or uncomfortable for pedestrians and bicycles;

Comprised of a variety of facilities, including FUTS trails, sidewalks, protected bikeways, and bike boulevards, as well as enhanced crossings and bridges or tunnels;

May be parallel to busy streets like Milton Road and Route 66, but are physically separated from traffic whenever possible to increase comfort and safety;

Include crossing facilities to help pedestrians and bicyclists through intersections and across streets.

- Segment 7: Cycle Track on Riordan Ranch Street, from Riordan Road to P13.
- Segment 8: Through NAU Parking Lot P13, aligned along the western edge of P13. Would remove 42 parking spaces.
- Segment 9: From P13 to NE Corner of former CVS site, west of Roseberry Apartments.
- Segment 10: New shared use path/FUTS trail.
- Segment 11: reconfigure DuPont Avenue to include a Cycle Track, Knoles Drive to McMullen Circle. Would require narrowing of travel lanes, and converting angle parking to perpendicular.
- Segment 12: Cycle Track on DuPont Avenue.

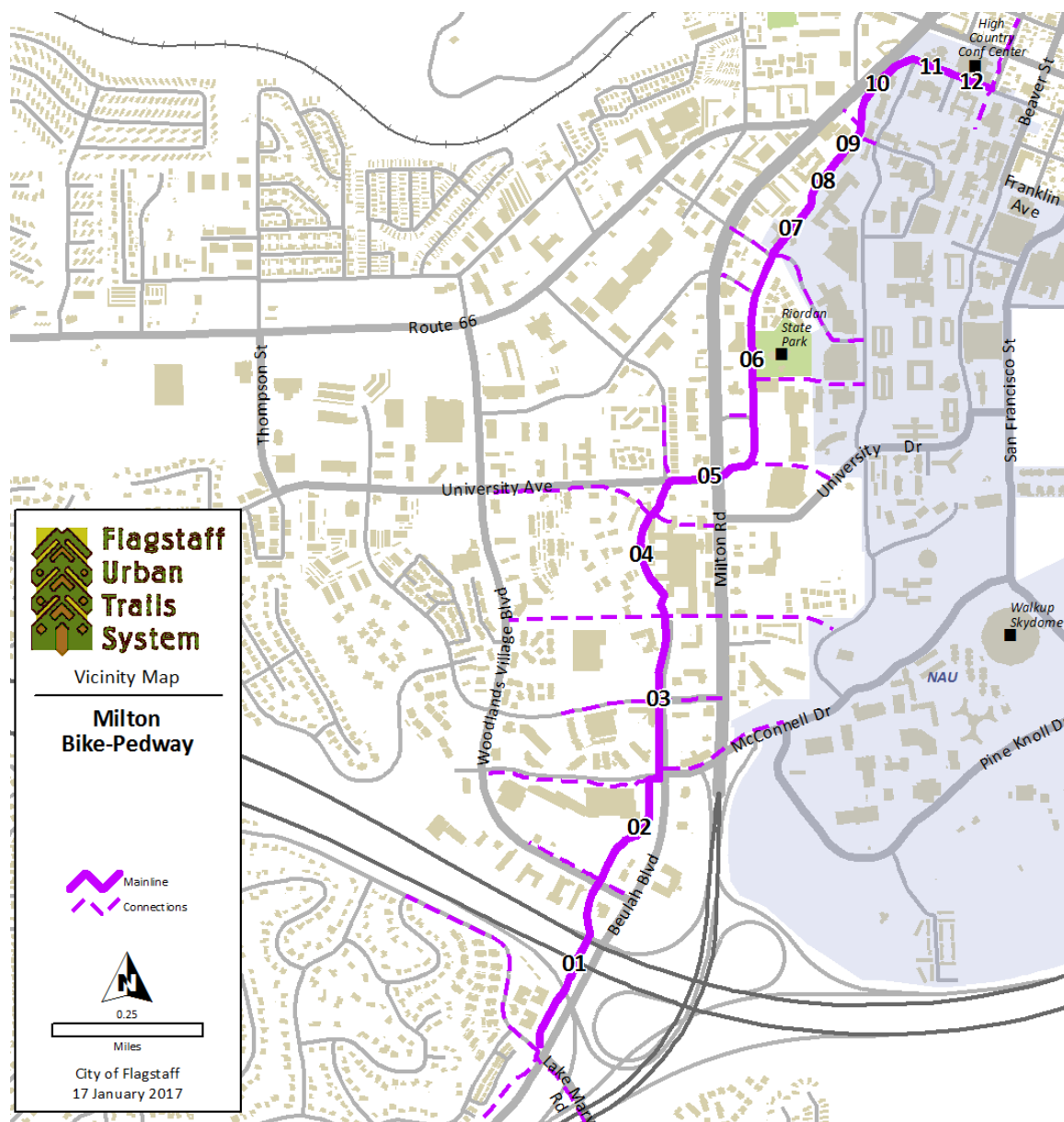


Figure 21. Milton Road BikePedWay Segments

Graphic source: FMPO

## 7. Other Recommendations

The NAU Multimodal Assessment identifies projects and methods to reduce the number of individuals traveling to and from campus in a single-occupant vehicle.

In addition to infrastructure-focused investments, non-infrastructure focused investments can help to reduce the number of individuals driving to campus in single vehicles. Transportation Demand Management (TDM), sometimes referred to as Travel Demand Management, refers to actions that “manage the demand for travel by drive-alone private car, rather than catering for that demand, or managing the road system.”

TDM provides people with a variety of mobility options (other than driving alone) to reduce driving and gain environmental, conservation, and sustainability benefits—generally without large infrastructure investments. Measures are directed at increasing vehicle occupancy, shifting travel mode or time of travel, or reducing the need for travel. TDM actions or measures come in many shapes and forms but are primarily categorized as follows:

- Employer or Institutional Support Actions
- Financial Incentives or Disincentives
- Alternative Work Arrangements
- Local and Regional Infrastructure and Policy

**Table 9** identifies actions, that may be considered by NAU, aimed at impacting traveler behavior by reducing the number of single-occupant vehicle trips. **Table 9** also provides guidance on each strategy’s ability to influence behavior, as well as relative cost.

*Table 9. Travel Demand Management Strategies*

TDM Strategy	Description	Propensity to Affect Behavior	Relative Cost to Implement
<b>INSTITUTIONAL SUPPORT ACTIONS</b>			
Alternative Transportation Manager	On-site professional provides personalized trip planning and commuter assistance. Coordinates education and outreach activities and events.	High	Moderate
Car-sharing	Car rentals available on-site to facilitate midday travel for individuals that do not drive to work/school. Enterprise or Zip Ride are examples of car-sharing programs. NAIPTA currently offers a van pool service.	High	Moderate
Bicycle and pedestrian education/encouragement during new hire and new student orientation	Orientation takes place prior to hiring or starting school to educate employees /students of alternative transportation options and costs. Aimed to influence decision on where to live, how to travel to school/work, and make other travel decisions	Moderate	Low
Preferential Parking	Designated to rideshare users (carpool or vanpool), particularly in areas where parking is limited.	Low	Low



TDM Strategy	Description	Propensity to Affect Behavior	Relative Cost to Implement
Fairs/Promotions	Periodic events held in public spaces to highlight TDM offerings (e.g. bike fair, bike to work/school week); use student orientation to teach students how to use bike lanes, shared lanes, etc.	Low	Low
Guaranteed Ride Home	Backup rides are offered to employees/ students who do not drive alone to campus. Typically provided through vouchers and/or reimbursement up to a designated number of time per period/semester	Low	Low
Bicycle Co-Op	Student run bicycle co-op that recovers abandoned bikes and repairs /reassembles/ repurposes them for incoming students; current bicycle co-op (Bike Hub) provides repairs for bicycles and can be further supported and marketed.	Low	Low
Mobility Office / Transit Hub / Bike Shop	Centralize the location of a TDM / mobility office and bike shop at an existing transit hub to create a one-stop shop	Low	Low
Bike Share	Support installation of bike share that is integrated with the City of Flagstaff. This will build upon the current “Yellow Bike” program on NAU campus. Consider flexibility of a smart bike / station-less system and bundling pricing with a car share membership or in lieu of parking pass.	Moderate	Low
<b>ALTERNATIVE WORK ARRANGEMENTS</b>			
Class Scheduling	Normalize travel demand by scheduling classes equally throughout the week and later in the day; consider travel demand when developing class schedules.	Moderate	Low
<b>FINANCIAL INCENTIVES/DISINCENTIVES</b>			
Increase Transit Subsidies	Reduced cost of transit by offering prepaid or discounted transit passes to students who agree to commute primarily by transit. When students purchase a bus pass, they also receive 30-parking days to use as needed. Employees currently are offered an annual Mountain Line Bus Pass at no charge.	High	Moderate
Restricted Parking	Underclassmen are restricted from using parking to reduce the amount needed. Effective if it is mandatory for on-campus lodging. Waived if proof of off-campus employment is provided.	High	High
Parking Fees	One of the most effective ways to affect travel behavior. The financial cost of providing parking is high and often not known by users. Passing along the cost of parking can educate users of the true cost of driving and impact their decisions.	High	High
Pay-as-you-go Passes	Incrementally transition from semester or annual parking passes to pay as you go Passes. Students then, when buying a pass’ don’t feel “locked into	High	Low

TDM Strategy	Description	Propensity to Affect Behavior	Relative Cost to Implement
	it” and have more flexibility to select other modes of travel. Arizona State University, for example, is transitioning from designated permit parking to pay-as-you-go parking open to visitors, students, and others. Revenues per space are higher.		
Required Bicycle Registration	Bike registration allows for campus police to return recovered stolen bikes and helps TDM manager to gather data on the number of bikes on campus.	Low	Low
30 Day Flex Parking Pass	Provided only to those registered in another program (bike, transit, walk commute) to allow flexibility to drive when necessary.	Moderate	Low
<b>Regional Policy</b>			
Permanent Bike Counters	In collaboration with City of Flagstaff, install permanent bike counters to gather data to determine on campus bike usage.	Moderate	Moderate
Determine TDM goals	Determine program objectives (potential targets and expected outcomes).	Moderate	Low
Information compiled from multiple sources, primarily the TCRP Report 95: Chapter 19 "Employer and Institutional TDM Strategies: Traveler Response to Transportation System Changes" (Transportation Research Board 2010).			

## 8. Facility Design Guidelines

The following design guidelines provide reference for improvements.

### **Manual on Uniform Traffic Control Devices for Streets and Highways.**

The PDF version of the 2009 MUTCD with Revision Numbers 1 and 2 incorporated, dated May 2012 is the most current edition of the official FHWA publication. The MUTCD contains the national standards governing all traffic control devices. All public agencies and owners of private roads open to public travel across the nation rely on the MUTCD to bring uniformity to the roadway. The MUTCD plays a critical role in improving safety and mobility of all road users. Available at: <https://mutcd.fhwa.dot.gov/>.

### **AASHTO Guide for the Development of Bicycle Facilities, 4th Edition**

This guide provides information on how to accommodate bicycle travel and operations in most riding environments. It is intended to present sound guidelines that result in facilities that meet the needs of bicyclists. Sufficient flexibility is permitted to encourage designs that are sensitive to local context and incorporate the needs of bicyclists, pedestrians, and motorists. However, in some sections of this guide, suggested minimum dimensions are provided. These are recommended only where further deviation from desirable values could increase crash frequency or severity. Available at: [https://bookstore.transportation.org/collection\\_detail.aspx?ID=116](https://bookstore.transportation.org/collection_detail.aspx?ID=116)

### **National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide**

The purpose of the NACTO Urban Bikeway Design Guide is to provide cities with state-of-the-practice solutions that can help create complete streets that are safe and enjoyable for bicyclists. For each treatment in the Guide, the reader will find three levels of guidance:

- Required: elements for which there is a strong consensus that the treatment cannot be implemented without.
- Recommended: elements for which there is a strong consensus of added value.
- Optional: elements that vary across cities and may add value depending on the situation.

It is important to note that many urban situations are complex; treatments must be tailored to the individual situation. Good engineering judgment based on deep knowledge of bicycle transportation should be a part of bikeway design.

Available at: <https://nacto.org/publication/urban-bikeway-design-guide/>

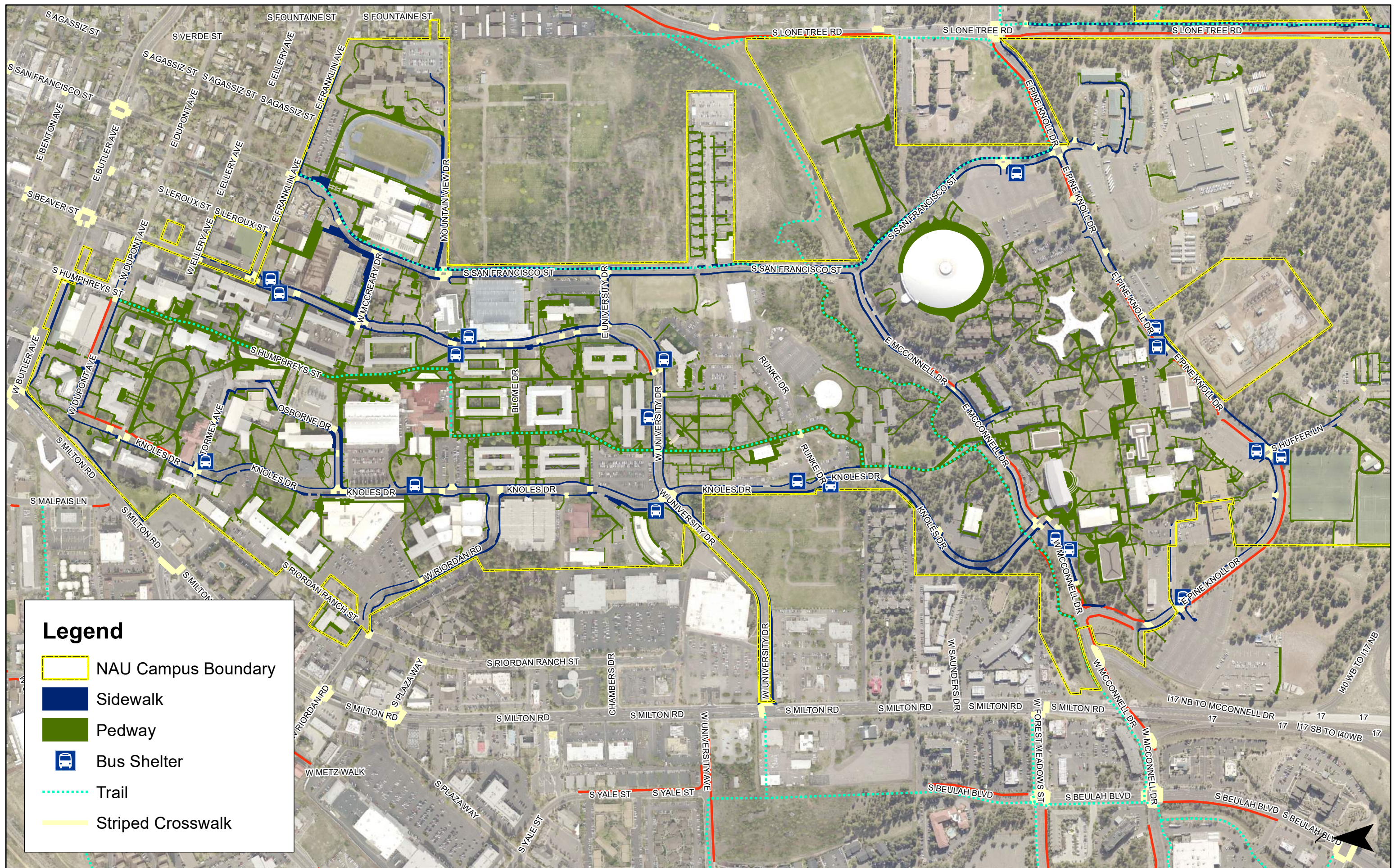


## **Appendix**

- A. Pedestrian Facilities Map
- B. Bicycle Facilities Map
- C. Stakeholder Interviews Summary

## **A. Existing Pedestrian Facilities Map**

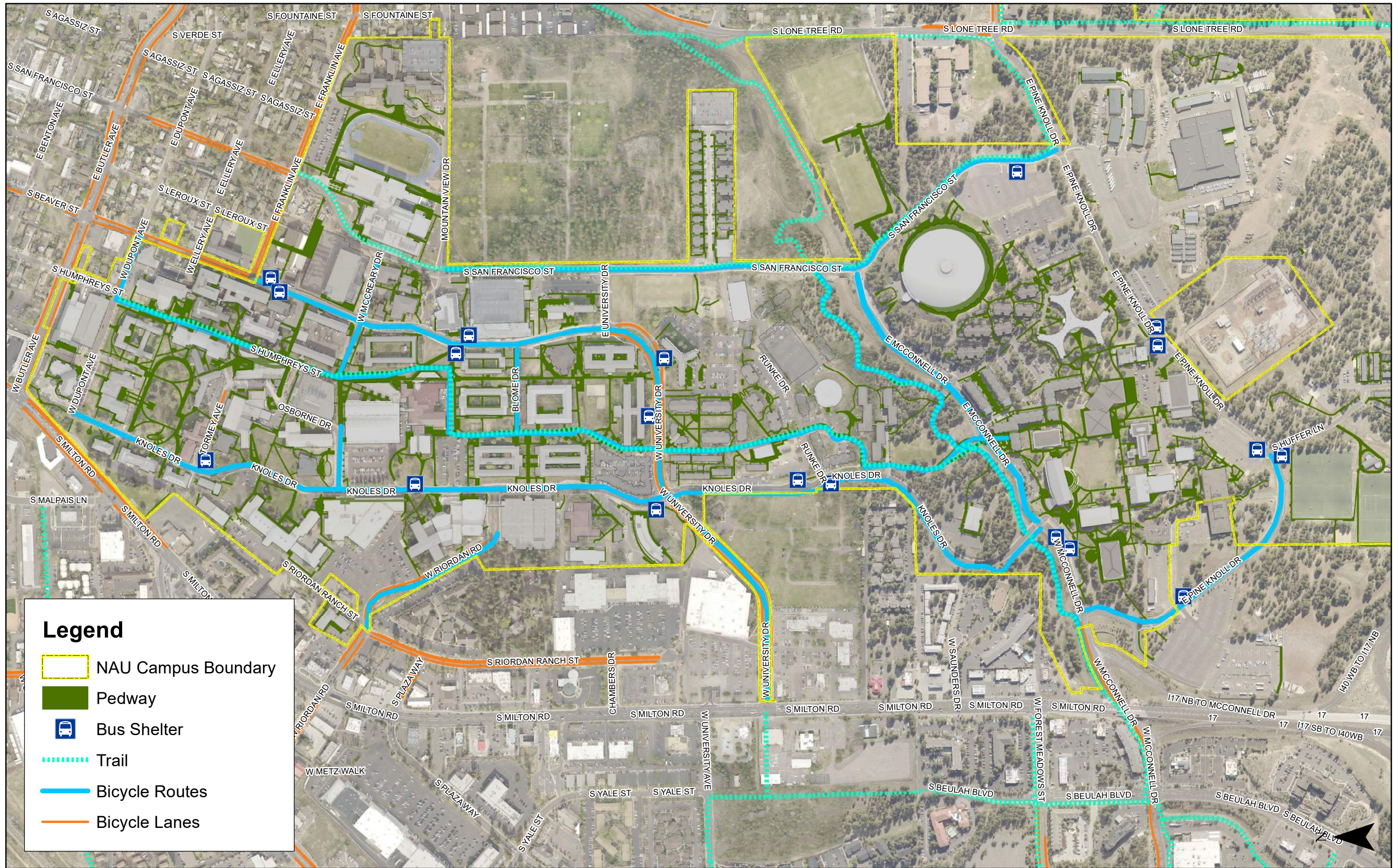






## **B. Existing Bicycle Facilities Map**







## **C. Stakeholder Interviews Summary**



## **Attachment 1 - TAC Meeting and Stakeholder Meeting Summaries**

Stakeholder Meeting #1, Northern Arizona University Police Department

October 9, 2017

10:00 am – 11:30 am

### **Attendees**

*Andrew Iacona*

*Marc Burdiss*

*Brad Mihalik*

*Melissa Freshour*

*Brent Crowther*

*Rebeca Field*

### **Discussion items**

1. In 2008, the amount of traffic was such that there wasn't enough time between classes for students to catch the bus. Student traffic controllers were brought in to help move traffic along, but there are still problems. Larger scale traffic improvements are needed because the campus can't just keep utilizing student workers.
2. Consider addressing evacuation needs in the plan.
3. Several suggestions were made regarding University, including left turn lanes, synching the lights, and re-alignment. Re-alignment is expected to occur in the next few years.
4. Consider the connection to the future CVS off of Milton. Rosemary Hall is in the way of a strong connection.
5. An evaluation of crosswalks is needed.
6. Parking garages and buses are not considered convenient. Parking garages are located in areas that are already too congested. Buses often have one-way routes and the transit time is too long. McConnell is now too narrow for buses because of the pedestrian bridge.
7. Consider the addition of more grade-separated crossings. San Francisco and McConnell would be a good location for a tunnel.
8. Consider converting lots near dome into parking garages. Challenge is to change the designation on P62 (currently state trust land, which allows only non-vertical parking).
9. Consider impacts of funeral processions on campus traffic.
10. Separation of cyclists/skateboarders is critical as mixed speeds cause issues.
11. Traffic calming is needed, especially at hills. Most roads have a speed limit of 15 mph.
12. Specific areas of concern:
  - a. McConnell & Pine Knoll - people can't move through the area although 3 intersections are staffed.
  - b. McCreary & San Francisco - traffic backs up due to pedestrian crossings, sometimes San Francisco backs up to Hilltop.
  - c. Bad pedestrian area in front of library
  - d. McConnell & San Francisco has a bike/skateboarder issue – the east side has a cable barrier and is frequently a location for medical assists (near Sky Dome).

- e. Bridge on McConnell creates a pinch point now that it's 2-way.
- f. Poor sight visibility (coming westbound) on University & crosswalk to Reilly Hall from Allen and Wilson Halls.
- g. Missing sidewalk on Pine Knoll west of San Francisco.
- h. Existing sidewalk on Runke dead ends into a street.
- i. S. side of McConnell near the interstate - need sidewalks on both sides.
- j. Crossing at Lone Tree doesn't seem to function, lights don't seem to work.
- k. McConnell & Pine Knoll – consider roundabout or traffic signal.
- l. Riordan and Riordan Ranch has a bad intersection alignment.
- m. Traffic backs up all the way to McConnell from Franklin along San Francisco.
- n. San Francisco by Hill Top – dangerous crossing situation because of grade.
- o. Knoles – some issues with pedestrians crossing in front of bus.

## **Attachment 1 - TAC Meeting and Stakeholder Meeting Summaries**

Stakeholder Meeting #2, NAU Office of Sustainability

October 9, 2017

2:30 pm – 4:00 pm

### **Attendees**

*Andrew Iacona*

*Ian Rodriguez*

*Lauren Copeland-Glenn*

*Christopher Thrash*

*Kristen Joy Morale*

*Ellen Vaughan*

*Brent Crowther*

*Rebeca Field*

### **Discussion items**

1. Consider contacting Dr. Ed Smaglick. He is a NAU professor that specializes in transportation.
2. Hardly any bike traffic seen on transit spine. Most desirable destinations are off pedway so bikes usually take that instead. Collaboration is needed with City to keep pedway consistent.
3. Clarity needed between where bikes and pedestrians should be – seems to be less confusion when bikes are in the center and pedestrians are on either side.
4. Pavers should not be used on campus – settle and create trip hazards.
5. Bus system is underutilized because people don't know how they connect. Better integration needed between bus and bike. More connections are needed to the outer community.
6. Parking services needs more buses. SBS west stop is often backed up – too many people, not enough buses. Consider adding large scale external park and rides.
7. Shuttle system could be created based on density map and should be routed through the campus.
8. Route 10 is free to students and should be expanded to more routes. Stops need to be in convenient locations.
9. Land south of I-40 is owned by NAU. Consider future connections.
10. Accessibility of campus must continue to improve – not just materials, but color contrast, signage, etc. Campus environment should be welcoming and inclusive. Consider Universal Design principles.
11. Areas of concern:
  - a. McConnell interchange is challenging for pedestrians. New buildings off McConnell don't have good access.
  - b. Franklin can also be inaccessible, especially in winter. Sidewalk/roadway is not well maintained. Entrances to P7A parking make blind spots.
  - c. Milton and Butler create campus barriers.
  - d. Riordan and Milton are also problematic. There is currently a lot of back-up onto campus with more inputs planned in the area.



- e. Beaver & Franklin interface with neighborhood.
- f. Beaver Street southbound right turn at Dupont.
- g. Student Union area – dogleg south of University Union Food Services.
- h. McCreary & San Francisco.
- i. Sidewalks at P16A aren't really accessible. Pavers create big holes. There is not a good transition between pedway & sidewalk.
- j. Sidewalks around Kline Library are too narrow.
- k. San Francisco & McConnell - people making right turn across traffic is a new issue. Easy to speed in this area.
- l. End of San Francisco bike path is confusing.
- m. Humphrey's & Butler – convert to Bike HAWK? Problematic for ADA.
- n. Sidewalk and cross-walks near Drury Hotel.

## **Attachment 1 - TAC Meeting and Stakeholder Meeting Summaries**

Stakeholder Meeting #3, NAIPTA and FMPO

October 10, 2017

8:30 am – 10:00 am

### **Attendees**

*Andrew Iacona*

*Martin Ince*

*Ann Dunno*

*Alicia Becker*

*Heather Fernandez*

*Brent Crowther*

*Rebeca Field*

### **Discussion items**

1. Old Master Plan showed parking on perimeter with no vehicles in campus core. Growth is still being studied. Master Plan is about 5 years out of date and needs to be re-evaluated. In the future, consider closing down some of the inner roads to vehicles except for buses.
2. Need separation of bike path where it merges with sidewalks.
3. Better transit access needed to Sinclair Wash. A bus-only lane through Sinclair Wash has been discussed.
4. East-west access needs to be strengthened. As part of this effort, the City has started a project on Lone Tree to complete connection across Cemetery.
5. Bike/pedestrian facility has been discussed parallel to Milton. Plan includes a cycle track facility & sidewalk.
6. Consider connecting to Wells Fargo from the Union.
7. A tunnel over the railroad along Route 66 is a long-term plan. However, the railroad has indicated that it won't be giving up any right-of-way. They are looking at adding a 3rd line.
8. Connection needed across Milton.
9. BRT project will provide downtown access via Milton.
10. Flagstaff is looking at a private model bike share system.
11. Consider providing bicycle orientation video to freshmen. Maps would be helpful to show the best route to get from point A to B. NAU has walkability maps related to LEED buildings; would be good to have expanded map.
12. Sinclair Wash trail should be paved. Current alignment has unnecessary curves. Consider addition of a tunnel.
13. NAU owns the land South of I-40. Connection needed. Consider a bridge across in the center. The Regional Transit Plan scoped the extension of Anita into this parcel. There is currently no priority connection for Coconino Community College into NAU campus.
14. 40% of Flagstaff population pulses in and out of campus every day. Consider prioritizing ingress/egress where employees live.
15. Areas of concern:

- a. Butler & San Francisco – high bus transfer point; 4 bus routes stop at Butler.
- b. No sidewalk at terminus at Runke.
- c. Problem with jay-walkers at SBS. Another pick-up and drop-off parking lot is needed.
- d. McConnell connection & impact to SBS hub.
- e. Realign McConnell to further away from wash, eliminate parking near building.
- f. Knoles on West side - no space to ride because pedestrians don't know it's a bike route. Add a separate 8' sidewalk.
- g. P13 lot has subsurface drainage issues.
- h. University Drive is a wide road with narrow sidewalks. This is an important connection into campus for buses.
- i. Butler & Humphries – NAU purchased parcel in area, potentially for bus stop for Mountain Link. Round Rapid Flashing Beacon is currently in-place. A pedestrian hybrid beacon will take its place. Humphries south of Butler might be closed to vehicles but there are property ownership issues.



## **Attachment 1 - TAC Meeting and Stakeholder Meeting Summaries**

Meeting with Ed Smaglick, NAU College of Engineering, Arizona Department of Transportation

October 10, 2017

1:00 pm – 1:30 pm

### **Attendees**

*Andrew Iacona*

*Ed Smaglick*

*Brendan Russo*

*Cready Smith*

*Brent Crowther*

*Rebeca Field*

### **Discussion items**

1. Consider focusing on how transit works within the 20-minute window between classes.
2. McConnell intersection is a significant problem area. The large monument at the McConnell interchange conflicts with possible intersection improvements.
3. Student vehicles need to be limited; this would free up a lot of options.
4. Consider getting counts on pedway vs Knoles.
5. Consider bike/pedestrian round-about at University Union.
6. ADOT is currently working on a project at the McConnell interchange. NAU prefers to have the sidewalk on the North side, but plans are unknown. The split-phase signal at McConnell and the striping create an issue. 3 signal adaptive control would be preferred. Capstone team looking at McConnell intersection and how to improve it.
7. Concrete FUTS trail to McConnell is being considered.
8. Pedestrian Hybrid Beacon is going in at Blackbird Roost and Route 66.